

ARCHIVED COPY:  
**TORS**

**DO NOT USE**  
Torsional Orthopaedic Revision System

# User Manual



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## Conventions used in this document

### Warning:



A statement that if not strictly followed could result in injury or loss of life, or a statement that is otherwise required to be a warning.

### Caution:

A statement that if not strictly followed could result in damage to the equipment

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### Intended use

TORS is an ultrasonic surgical device intended to be used for removal of polymethylmethacrylate (PMMA) bone cement in orthopaedic applications. It is also intended to be used for cutting and cauterising soft tissue during skin and muscle incision to access bone joints in limbs.

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control and minimal thermal injury are important.

### Contraindications

- Do not use, if in the judgment of the surgeon, the use of ultrasonic surgical techniques are not in the best interest of the patient.
- Do not use for incising bone.
- The Soft tissue transducer is not indicated for the cutting of vessels exceeding 1.5mm in diameter or bone tissue.

**Please read all Warning & Cautions contained in this document**

# The TORS System

## Generator

### Front Panel

The screen is highly visible, especially in a darkened operating theatre, indicates operating mode selected and gives concise instructions on action required in the event of disruption to normal operation.

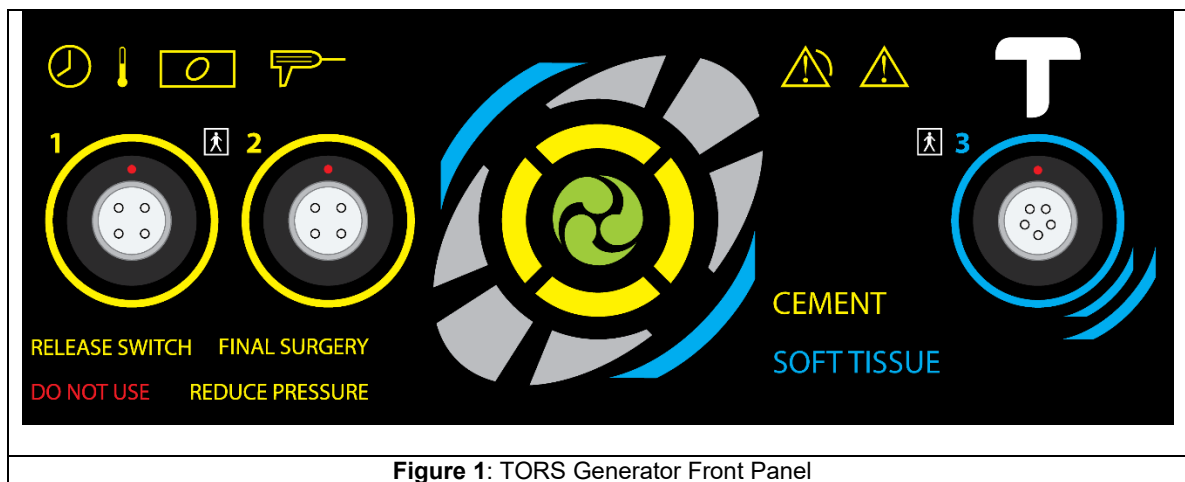


Figure 1: TORS Generator Front Panel

### Rear Panel

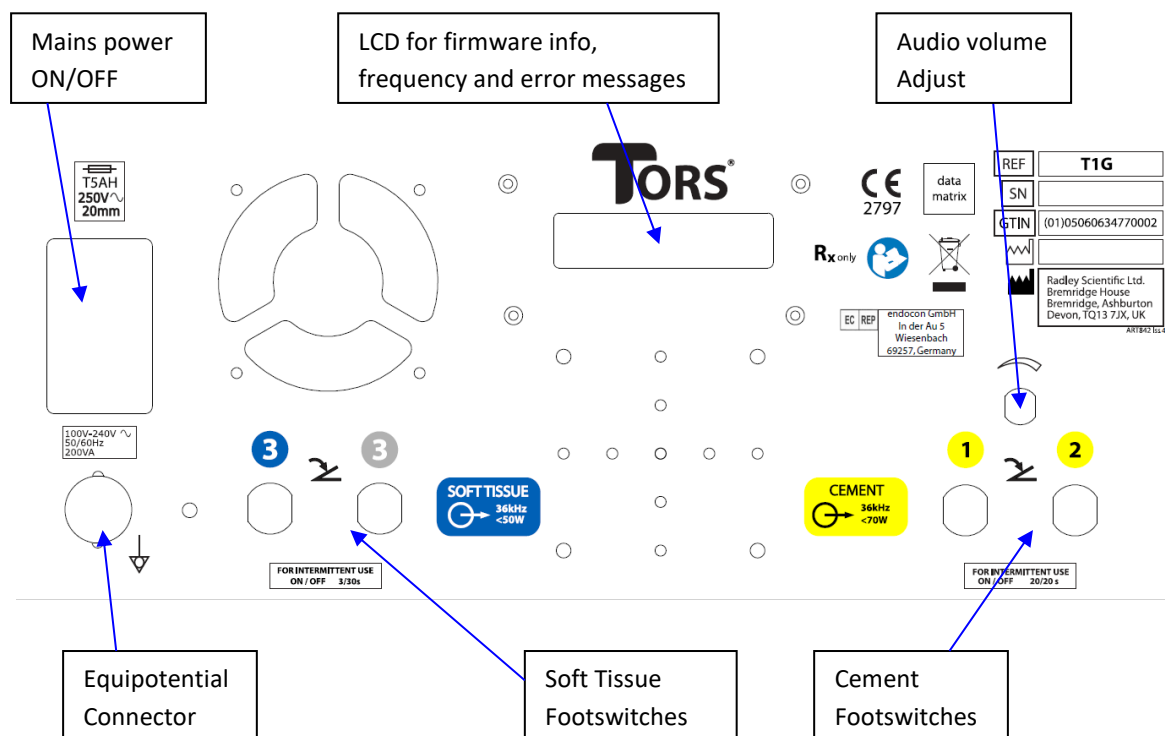


Figure 2: TORS Generator Rear Panel

There is only one user control on the Generator itself:

- Volume control (on the rear panel)

## TORS Transducers & Cables



**Figure 3:** TORS Cement Transducer



**Figure 4:** TORS Soft Tissue Transducer + Probe



**Figure 5:** Cement Cable



**Figure 6** – Axial Grip



**Figure 7** – Axial Grip with TDCR and Probe fitted

## Safety

### Warnings

- This device should only be used by surgeons who are (1) trained in the types of surgical procedures that are to be carried out and (2) trained in the specific use of ultrasonic surgical instruments.
- Do not operate TORS in a potentially explosive or flammable area, or in oxygen rich environments. Note that if the Probe touches anything metal while activated, sparks may be produced.
- The use of TORS in cases where a patient or an operator of the unit has been fitted with a cardiac pacemaker is left to the discretion of the consultant in charge of the procedure although no electrical flow is made through or into the patient and many clinical papers on the use of ultrasound in the proximity of cardiac pacemakers have been published.
- Appropriate protective measures, including smoke evacuation, should be taken to protect users from any smoke, or other aerosols, produced by the use of surgical ultrasound.
- Use extreme caution when using in the vicinity of nerves.
- Handle the acoustics (Transducers and Probes) with care.
- Do not attempt to modify the acoustics. No modification of this equipment is allowed.
- The use of transducers or handpieces not supplied as part of the TORS system may damage the Generator and create a safety hazard for the operator and patient.
- Avoid touching or holding the blade at the end of the energized Probe. It is designed to produce heat!
- Other than the activated tip, do not allow probe to be in contact with tissue.
- Irrigate the femoral canal after each activation.
- If the probe is deactivated inside heated PMMA it is possible the cooling cement will adhere very strongly to the probe, in which case it may become difficult to reactivate the probe in order to remove it from the cement.
- When guiding the TORS Cement Probe through PMMA, care must be taken not to exert excessive force in order to maintain control of the direction of travel of the Probe.
- Use of excessive force in vicinity of thin bone may cause perforation.
- Avoid resting the blade on skin or other tissue for at least 10s after cessation of energizing as it will have become hot while cutting. Ultrasonic systems dissipate heat quickly. (User may quench hot Probe tip / blade in saline)
- Care should be taken when in contact with tissue between activations, in case accidental activation should occur.
- If the Probe comes into contact with bone, using recommended cooling strategies a bone temperature of up to 51°C may be seen.
- Allowing active tip to contact bone may cause damage to the bone.
- Wherever possible avoid contact between the side of active Probe and patient tissue.
- Mains isolation is achieved by use of the double pole switch located on the rear panel. DO NOT position the equipment in such a way as to make access to this disconnection switch difficult.
- To avoid the risk of electric shock, this equipment must only be connected to a main's supply with protective earth.
- TORS is not MR safe or MR compatible.
- Do not re-sterilize or reuse any Single Use parts.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of TORS, including cables specified by RSL. Otherwise, degradation of the performance of this equipment could result.
- TORS should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary TORS should be observed to verify normal operation in the configuration in which it will be used
- The use of accessories, transducers and cables other than those specified may result in increased emissions, decreased immunity or improper operation.
- There are no user serviceable parts.

## Cautions

- U.S. law restricts this device to sale by or on the order of a licensed physician.
- The nursing staff must be trained so that they are familiar with the equipment to be used.
- Avoid allowing an energized Probe to come into contact with any metal surface.
- Do not sterilize the TORS generator or Footswitch
- Do not block or otherwise restrict the vents on the rear and bottom panels.
- Never allow electrosurgical equipment to contact the Probe.
- Always transport TORS using the supplied transport cases.
- The TORS generator has an Equipotential terminal on the back panel. This is provided for compatibility with other medical systems requiring such connections. This conductor is not intended for protective earthing. Refer to EN 60601-1 for details of use with ME Systems.
- TORS:
  - i. should be used only for those procedures for which it is indicated.
  - ii. should be used with an appropriate power level commensurate with the required task.
  - iii. should be used with correct surgical technique.

If used correctly the TORS should cut and coagulate tissue and remove PMMA cement to the satisfaction of the user.

The equipment should inform the user of its status either by audio or visual means, unless ultrasound output is not possible. However, if a fault with the audio or visual indicators occurs whilst a cut is in progress, it may allow that cut to be completed without indication.

## Electromagnetic Interference

- This equipment is only suitable for use in hospital operating theatre / operating room.
- The performance of TORS may be degraded if it is subjected to electromagnetic disturbances e.g. an incorrect display that clears automatically once activate switch is pressed/depressed.
- Do not use TORS simultaneously with laser equipment or high frequency surgical equipment.
- This equipment has been tested and found to comply with the limits for a medical device.

However should interference occur, the user can try the following measures:-

1. Turn equipment off and on to confirm the source of the interference.
  2. Increase separation between this equipment and other devices.
  3. Connect this equipment to a power socket different from that to which the other devices are connected.
  4. Consult medical physics department.
- The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.
  - Where replacement Transducers and Cables are required, these must be manufactured by RSL (see Appendix 2 for full listing),
  - See also Appendix 3: Electromagnetic Interference.

## Complications and Potential Side-effects

### General risks and complications of arthroplasty surgery

- Bone loss during prosthesis and/or cement removal
- Cortical perforation
- Fracture in the bone around the artificial joint
- Recovery time, pain and potential for arthritis associated with deliberate osteotomy
- Nerve/vascular lesions
- Rebleeding or haematoma / seroma
- Ligament, artery or nerve damage in the area around the knee joint
- Blood clots or deep vein thrombosis or pulmonary embolism
- Haemorrhage caused by tissue injury or ineffective haemostasis
- Bone/joint infection
- Late infection
- Infection of the wound and/or the tissue around the artificial joint
- Thromboembolism
- Implants or metal parts remaining in joint
- Fatigue fracture
- Excess bone forming around the artificial joint (knee) restricting movement
- Excess scar tissue forming and restricting movement
- Kneecap or hip dislocation
- Numbness in the vicinity of the wound scar
- Loosening of the artificial joint (normally after 10-15 years)
- Joint wear and tear
- Joint stiffening
- Bone cement implantation syndrome
- Hypoxia
- Hypotension
- Cardiac arrhythmias
- Cardiovascular collapse
- Thermal injury due to cement polymerization (setting) reaction
- Contact inhalational exposure to PMMA monomer leading to hypersensitivity
- Asthmatic reactions
- Neurological symptoms
- Localized irritation
- Personal risks from anesthetic or the surgery itself

### Potential side-effects of ultrasonic arthroplasty surgery

- Necrosis and clinical dysfunction in femoral cortex and surrounding soft tissue due to heat transmission from ultrasonic probe/cement interface
- Intramedullary canal perforation

- Different tissues and bone cement will be heated to different degrees with the same ultrasound parameters
- Each cell type has a different susceptibility to thermal injury
- Pathologic humeral fracture
- Microscopic bone cracks
- Plume production (95% water, 5% cell debris)
- Radial nerve palsy
- Risk of cross-infection from re-sterilized reusable parts of the system

#### General complications of powered dissection in open soft tissue surgery

- Acute or delayed bleeding (blood loss), organ perforation or fistula formation
- Haemorrhage caused by tissue injury or ineffective haemostasis
- Necrosis due to excessive heat transmission from the dissector
- Infections at the site of application
- Nerve lesions/damage

#### Potential side-effects of ultrasonic powered dissection in open soft tissue surgery

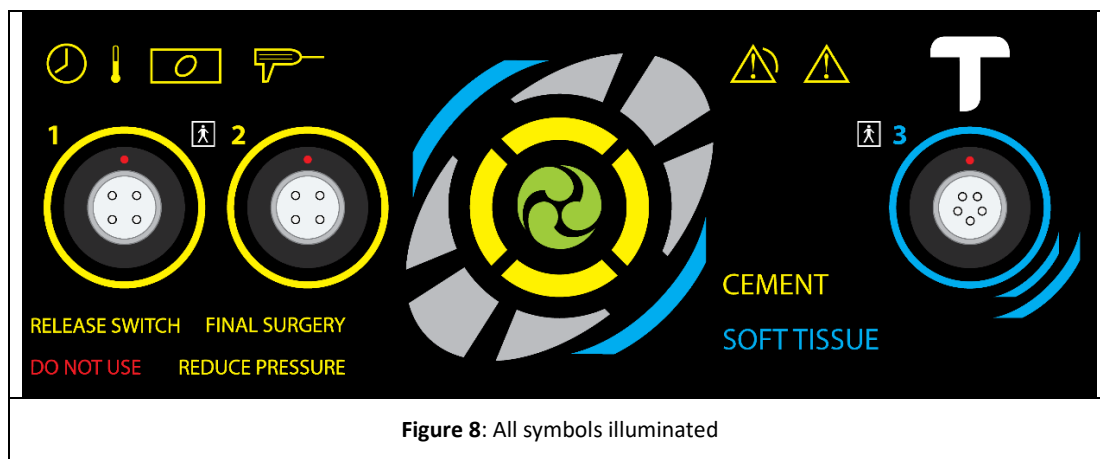
- Necrosis in soft tissue due to cavitation/shock waves or excessive heat from ultrasonic probe
- Visibility reduction due to plume production (95% water, 5% cell debris) or smoke production
- Risk of transmission of mutagenic or toxic chemicals in the plume
- Risk of cross-infection from re-sterilized reusable parts of the system
- Device breakage and loss of components in the body cavity

# Instructions for Use

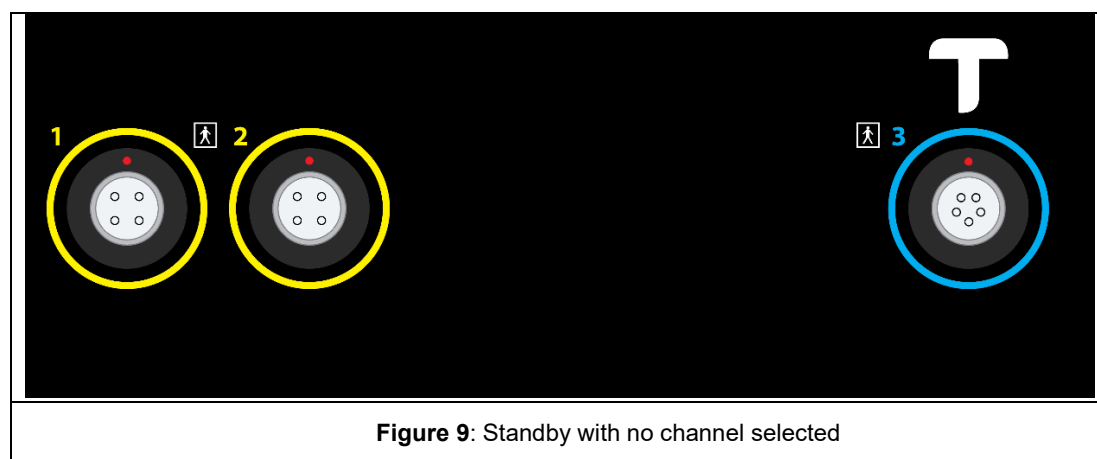
## Setting Up the TORS System

### Power up the Generator

- Connect the mains lead to the rear panel of the Generator.
- Press the Mains rocker switch up, "I", to switch on.
- The Generator will now power up with an audio indicator flourish of tones, conduct a brief full screen illumination test as shown in Figure 8.



- After approximately one second the display will show:



### Optional - Attach the "Cement" footswitch to the Rear Panel

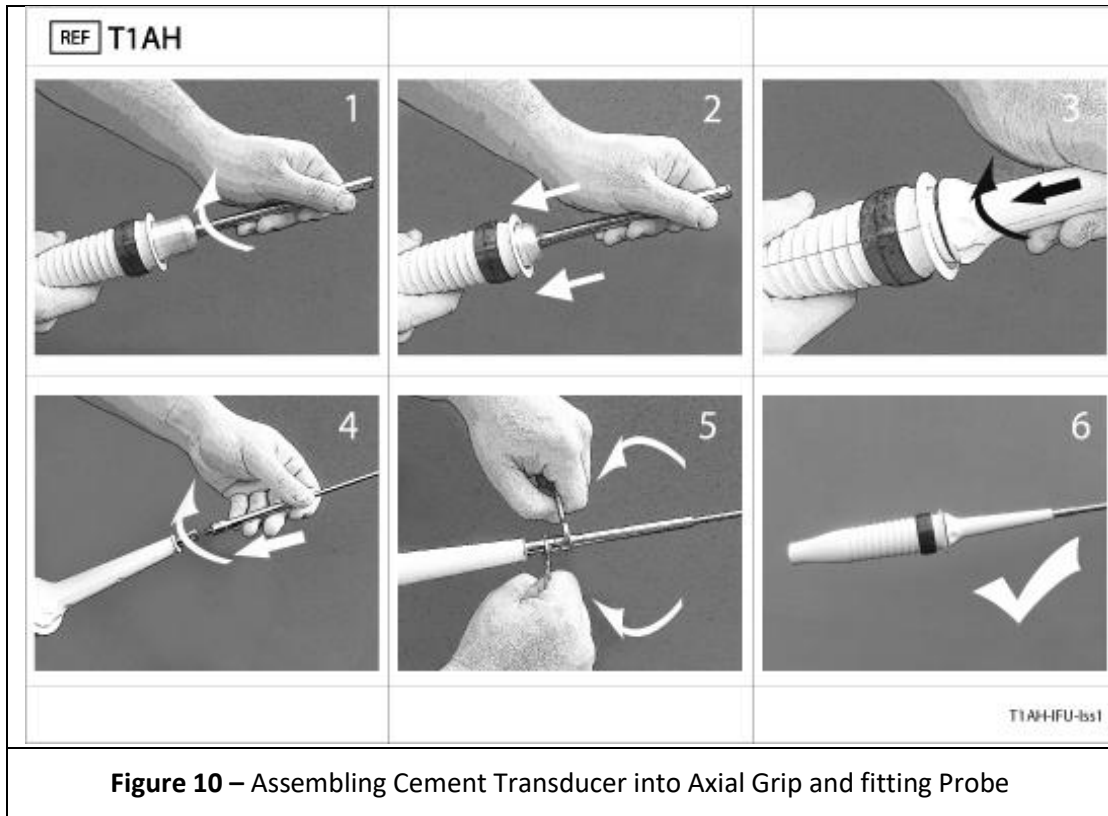
- The tube with the **Yellow** + "1" collar attaches to the similarly marked connection.
- The tube with the **Yellow** + "2" collar attaches to the similarly marked connection.

### Attach the "Soft Tissue" footswitch to the Rear Panel.

- The tube with the **Grey** + "3" collar attaches to the similarly marked connection.
- The tube with the **Blue** + "3" collar attaches to the similarly marked connection.

### Assemble the Cement Transducer + Probe (Applied Part)

- Select the pre-sterilized Cement transducer.
- Select the appropriate pre-sterilized reusable Probe.
- Select the Single Use Cement handpiece ( T1AH Axial Grip and Sleeve ).
- Fit the Transducer into the Handpiece. Rotate and click into place – ensure that it is securely connected. See (1) & (2) in Figure 10 below.
- Slide the Handpiece sleeve over the Transducer horn. Locate the lugs at the base of the sleeve into the grip Handpiece and twist / click into place. See (3) below.
- Using supplied spanners, attach the Probe to the Transducer (4) & (5) below.



### Optional - Attach the Soft Tissue Transducer (Applied Part)

- Remove the plug cap by pulling the knurled rings on the plug and the autoclave cap.
- Align the red dot on the metal plug with the red dot on the Generator socket.
- Connect the Transducer to Generator Channel 3.
- Push the plug into the socket until it clicks.
- To remove, pull back on the knurled part of the plug - **Do not** pull the cable.

## Cement Transducer - Connect

- Connect the Cement cable (Yellow coding) to Generator Channel 1 or 2 (Yellow rings) by aligning the red dot on the metal plug with the red dot on the Generator socket. Push the plug into the socket until it clicks.
- Connect the other end of the Cement cable (Plastic connector) to the Cement handpiece. Align the arrow on the plastic connector with the slot in the rear connector on the Axial grip. Click into place.
- To remove, pull back on the knurled part of the plug - **Do not** pull the cable.

## Cement Transducer - Initialise

- When the surgeon is ready to use the transducer they must initialize it to enable power. This is done simply by pressing the black activate button or yellow Footswitch (Ch1 or Ch2). The display shows:

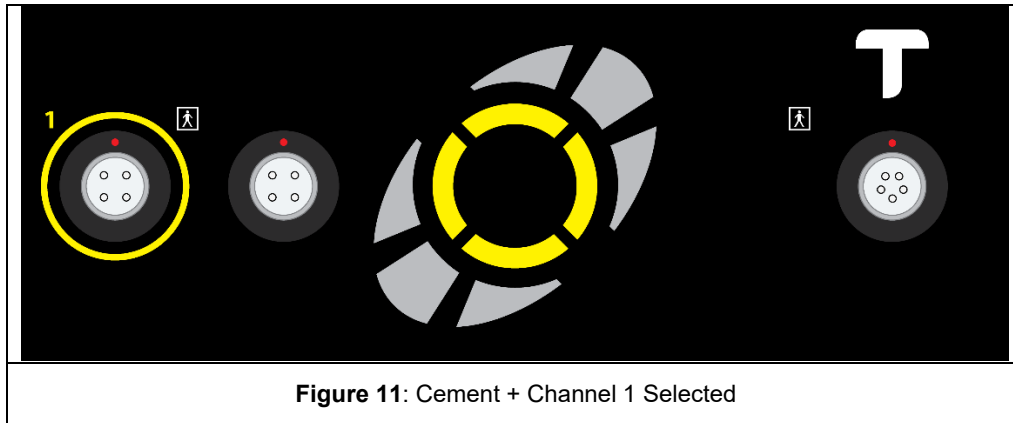


Figure 11: Cement + Channel 1 Selected

## Cement Transducer - Activate

- Press the black activate button on the Handpiece or the yellow Footswitch. This will energize the Transducer and Probe for surgery. An audible indicator signifies power delivery with a continuous low-pitched tone.

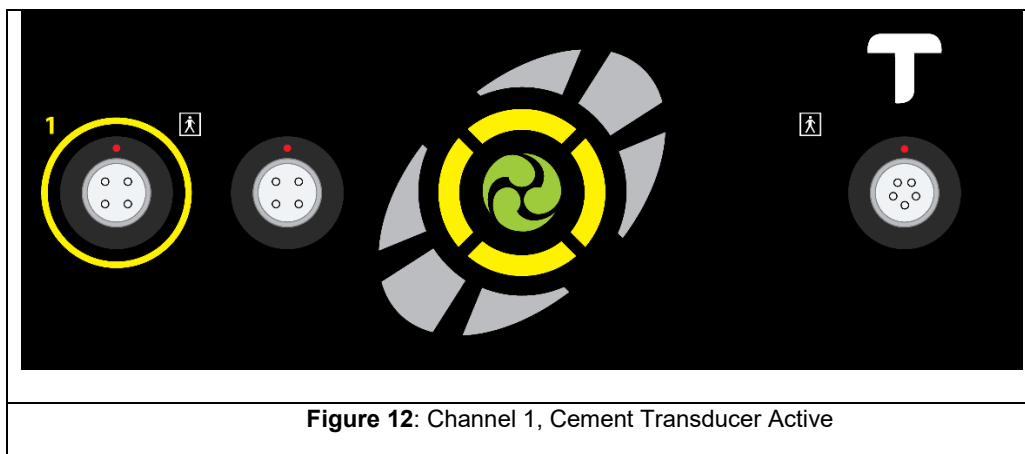


Figure 12: Channel 1, Cement Transducer Active

- To stop output, release the Footswitch or activate button.
- If the Footswitch or activate button is held down continuously for 20 seconds the audio indicator sound will change from continuous to pulsed.
- After a further 5 seconds the Generator will terminate power.
  - Output power is cut
  - Audible indicator stops
  - Displays Warning symbol + Transducer symbol + Clock symbol.
- These will remain illuminated as long as the Footswitch or activate button pressed.

- When it is released, normal operation resumes

### **Cement Removal – Irrigation**

It is important to irrigate the bone canal during the cement removal process for two reasons:- It clears the canal of cement debris, including dust, and it also helps maintain safe operating temperatures within the canal. Such Irrigation systems are standard provision in orthopaedic cases.

It is recommended that irrigation in the form of pulsed lavage or manual irrigation is used after each activation of any Probe.

Do not irrigate *during* an activation as this may compromise the efficacy of the ultrasound transmission, translating to a slower cement removal process. The TORS probes are designed to produce rapid heating at the Probe / PMMA interface, thus softening the cement. Any cooling during this process will impede the desired effect.

Any waste products should be disposed of as per normal hospital procedures.

### **Fume Extraction**

It is recommended that a suitable extraction system is used to remove smoke, aerosols and any associated odors.

Any waste products should be disposed of as per normal hospital procedures.

### Soft Tissue Transducer - Connect

- Plug a Soft tissue transducer into front Channel 3 (Blue ring) by aligning the red dots on the plug and connector receptacle. Push connector and click into place.

### Soft Tissue Transducer - Initialize

- Press the Ch3 grey Footswitch to select the channel.
- Audio triple downwards tone.
- Note that it will default to low power (single bar). The display shows:



Figure 13 Soft tissue transducer Initialize

### Soft Tissue Transducer - Change Power Level

- If high power is required press the grey Footswitch again.
- Audio triple upwards tone. The display shows:



Figure 14 Soft tissue transducer – high power selected

- Further presses will toggle between low & high power.

### Soft Tissue Transducer – Activate

- Press the Ch3 blue Footswitch. This will energize the Soft tissue transducer.
- Audio continuous tone signifies power delivery. Display shows:



Figure 15 Soft tissue transducer active - low power

or



Figure 16 Soft tissue transducer active - high power






Depending upon power level selected


- To stop output, release the blue Footswitch.
- If the Footswitch is held down continuously for 20 seconds the audio indicator sound will change from continuous to pulsed.
- After a further 5 seconds the Generator will terminate power.
  - Output power is cut
  - Audible indicator stops
  - Displays Warning symbol + Transducer symbol + Clock symbol
- These will remain illuminated as long as the blue Footswitch pressed.
- When it is released, normal operation resumes.

### Turn Off TORS

- Press the black ON/OFF power switch at the rear of the unit. The screen will become entirely black.


**Fault / Warning Indicators: (see also Appendix 4: Tones and Beeps)**

 <p>The Illuminated yellow triangle indicates that a fault has occurred.</p>	<b>It will always be accompanied by:</b>	
	i. An illuminated symbol indicating the part of the equipment where the fault has occurred	
		
	ii. Illuminated text instructing the user e.g. Reduce Pressure	<p>REDUCE PRESSURE</p> <p>Or</p> <p>RELEASE SWITCH</p> <p>Or</p> <p>DO NOT USE</p>
	If warning relates to time, the clock symbol also illuminates	
If warning is temperature related the temp symbol also illuminates		

<p>DO NOT USE</p> <p>+</p> 	<p><b>Soft tissue</b> transducer lifetime is nearly or over 100%. A high-low tone will sound. Prevents use of the Transducer.</p> <p>NB. Cement transducer lifetime is not monitored</p>
--	--


<p><b>FINAL SURGERY</b></p> <p>This will only occur during use</p>	<p>Soft tissue transducer lifetime is nearly or over 100%. A high-low tone will sound. Allows use of Transducer for the duration of the current procedure.</p>
--	--


Note. The working lifetime of the tissue transducer is detailed in the Decontamination section (Page 23.)

	<p><b>INCORRECT TRANSDUCER</b></p> <p>Transducer has been inserted in wrong socket. A high-low tone will sound. Prevents use of the Transducer.</p>
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<p><b>REDUCE PRESSURE</b></p>	<p>Too much force is being applied to the TDCR during activation. Reduce applied force to improve performance. Excessive force applied during activation can impede cutting performance.</p>
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<p><b>RELEASE SWITCH</b></p>	<p>Handpiece button or Footswitch held in. A high-low tone will sound.</p>
------------------------------	--

	<p>Transducer frequency too low. A high-low tone will sound. Try again after 5- 10s.</p>
---	--

	<p>Alarm – This symbol is not currently used in TORS.</p>
---	---



+



The Generator has detected a problem with the connections to the Transducer. The warning triangle will illuminate and a triple high-high-high tone will sound and repeat. Switch OFF then ON to clear fault. Re-energise the Transducer away from the patient – if fault recurs then change the Transducer and return for service.



+



The Generator has detected a problem. The warning triangle will illuminate and a triple high-high-high tone will sound and repeat. Switch OFF then ON to clear fault. Switch generator back on – if fault recurs then return the system for service.

## DECONTAMINATION

The Cement handpiece is supplied pre-sterilized and is designed for single patient use.








After use the Cement handpiece should be disposed of as per normal theatre protocol, ideally in a suitably sized biohazard container.





The Cement Handpiece is not designed for cleaning and sterilization after use. Post-operative cleaning and sterilization processes have not been validated by the manufacturer and any attempt at such process could cause the Cement handpiece to malfunction.

Both the Cement and Soft-Tissue Transducers can be cleaned and sterilized after use. See **Equipment Care** below for guidance on inspecting and replacing transducers and Cement Probes.

Cement probes are detached from Cement transducers for decontamination.

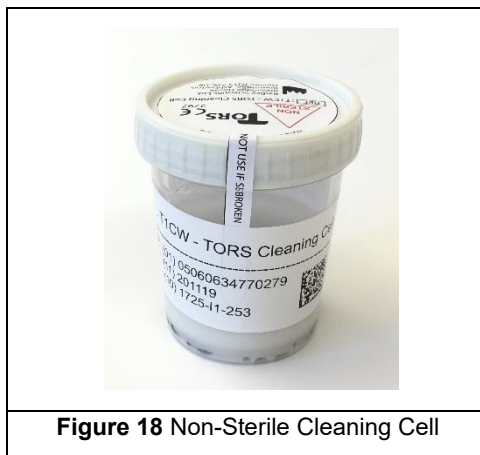
Soft tissue probe is NOT detached from Soft tissue transducer. It is washed and sterilized on the transducer for reuse.

	<p>T1AH - Cement axial grip handpiece (Single Use)  <b>Supplied Sterile (ethylene oxide)</b>  <b>Do Not Use if packaging has been damaged!</b></p>	 
	<p>T1CT - Cement transducer (Reusable Applied Part)</p>	
	<p>T1TT - Soft tissue transducer + Probe (remains attached for decontamination and reuse) (Reusable Applied Part)</p>	

	<p>T1CC Cement cable (Reusable)</p>	
	<p>P4,6,8,10R2, S6,8,10R2 - Cement probes</p> <p>T1EC, T1ES – Extension bars</p> <p>(Reusable Applied Part)</p>	
<p align="center"><b>Figure 17 Sterile parts</b></p>		

**Reprocessing Guidelines: Immediately After Use in Operating Theatre (OR)**

- Immediately after use wipe down all components and remove any surplus body fluids and debris.
- After final use some of the cement may remain adhered to the probe distal end, particularly within holes in the Piercer probe heads. This is easily removed by activating the blade in a suspension of fine abrasive grit in water. This is provided with the TORS system in the form of a single use cleaning cell.



**Figure 18 Non-Sterile Cleaning Cell**

**IMPORTANT: The cleaning cell is NOT sterile.  
NOT for use *during* procedure**

**ONLY use at the end of the procedure prior to washing and reesterilization of probes**

- Unscrew the cleaning cell lid and pierce the foil seal with the first probe. Activate each used probe in turn in the grit/water suspension in the cleaning cell, swirling the head around in the suspension for 20s. at least. Repeat if necessary. This will remove cement adhered to the surfaces.

### **After Use**

Detach the Cement Cable(s) from the Cement Transducer(s) by disconnecting from the handpiece.

Remove the Sleeve from the Grip on the Cement Handpiece. Detach the Handpiece from the Cement Transducer by pulling the Transducer and the Handpiece apart.

Detach the Cement probe from the Cement Transducer using BOTH supplied spanners.

### **Do not detached the Soft tissue probe or cable from the Soft Tissue Transducer**

Replace the Transducers, Cables, reusable Probes and spanners back into the autoclave tray, preferably within its original wrap to reduce drying of soil while it is returned to the cleaning facility.

### **Single Use Items**

Dispose of the Cement Handpiece Grip and Sleeve as per hospital protocols.

### **Reusable Items**

#### **Manual Cleaning**

- Prepare enzymatic cleaning solution (e.g. Gigazyme Plus) to manufacturer's instructions.
- Soak soiled instruments in enzymatic solution for 5 minutes.
- When cleaning, fully submerge the instruments in the cleaning solution. Brush with soft non-metallic bristle brush or cloth to remove all traces of blood and debris, concentrating on any crevices, seams, or other surface discontinuities. Clean holes and recesses using an appropriate brush ensuring that the full depth of the feature is reached. Ensure instruments are visibly clean before progressing to the next step.
- Rinse instruments thoroughly with clean running water for 2 minutes. Ensure that blind holes and recesses are repeatedly filled and emptied with running water.
- Dry instruments immediately after final rinse. Do not exceed 140°C (285°F)

#### **Automated Cleaning**

- Instruments may require manual cleaning prior to automated cleaning to improve the removal of adherent soil. Brush with a non-metallic bristle brush in enzymatic cleaning solution.
- Load instruments such that crevices, seams, surface discontinuities, holes and recesses can drain.
- Clean using the "Instruments" cycle in a validated washer disinfectant and a pH neutral cleaning agent intended for use in automatic cleaning (e.g. Getinge Enzymatic Detergent). The cleaning cycle should incorporate pre-rinse, wash, rinse, thermal rinse and drying steps. The duration and temperature of the steps may vary between different washing systems/devices but any washer/disinfectant cycle which is validated to ISO 15583-1, ISO 15883-2 & HTM 01-01 part D is suitable for processing the TORS device(s). Do not exceed 140°C (285°F).
- An alkaline cleaning solution such as, for example, Serchem pH Plus Detergent, with a pH up to 13.2 may be used instead of, or in addition to, an enzymatic solution.

#### **Cleaning Inspection**

- Inspect all instruments prior to sterilization or storage to ensure the complete removal of soiled surfaces.
- Visually inspect instruments, if soil is still present clean instruments again.

- Inspect cables for wear and damage, ensuring that no cracks, tears, or other damage is found.
- Check to see that Probes are free of scratches.
- Report any damage found to the Radley Scientific representative.

### **Wrapping**

- Double wrap in accordance with local procedures, using standard procedures wrapping techniques such as those described in HTM 01-01 or ANSI/AAMI ST46-1993
- Label contents of wrapped tray using indelible marker or other sterilization compatible label system.

### **Sterilization**

- Sterilization is best achieved on the day preceding the surgery, but must be at least one hour prior to use to allow the equipment to cool and stabilize.
- △ Transducers are NOT to be submerged in water to expedite cooling.
- △ Do NOT sterilize the Generator or Footswitches
- These components have been validated for sterilization by the following method in a vacuum autoclave. The parameters for this being 134-137°C (270°- 277°F) for a minimum of 3 and a maximum of 4 minutes. (If national standards dictate autoclaving up to 18 minutes, this is possible but not preferable.)
- Next Use - After decontamination, the Transducers, Cement cables, probes and spanners can be re-sterilized as above.

### **End of Life Management**

When a Soft Tissue Transducer has reached the end of its lifetime please contact your local TORS supplier.

TORS generator and all reusable accessories (including Transducers) should be recycled. Contact RSL for return instructions - see end page of this IFU.

**A valid decontamination certificate must accompany each returned Transducer, Probe or Cement cable.**

### **Opened in Error**

In the event of a Single Use Handpiece being unwrapped in error, it may not be re-sterilized.

Care should be taken to ensure that the cables are not kinked during sterilization as this can produce cracks in the cable and reduce cable life.

### **Cleaning the Generator**

The TORS Generator may be cleaned as follows:

- i. Dilute a neutral pH detergent according to the manufacturer's directions.
- ii. Using above solution, lightly moisten a soft, clean cloth. Wipe surfaces of the Generator.
- iii. Using tap water, lightly moisten a soft, clean cloth. Wipe surfaces of the Generator.
- iv. Dry Generator surfaces with a soft clean cloth.

### **Cleaning the Footswitch**

The TORS Footswitches may be cleaned as follows:

- i. Dilute a neutral pH detergent according to the manufacturer's directions.
- ii. Using above solution, lightly moisten a soft, clean cloth. Wipe surfaces of the Footswitch.

- iii. Using tap water, lightly moisten a soft, clean cloth. Wipe surfaces of the Footswitch.
- iv. Dry Footswitch surfaces with a soft clean cloth.
- v. Do not allow any water to enter into the air-hoses.
- vi. Do not detach the air hoses from the Footswitch.

# Equipment Care

## Probe Inspection

Before use it is recommended that the Probe be inspected for damage.

TORS Probes are susceptible to damage if forced into contact with metal (e.g. hand instruments and clamps, etc.) when active. The consequence of deformation or scratching a Probe is to raise the mechanical stress in the region of the scratch (creating a "stress raiser") when the Probe is vibrating. If the stress is raised sufficiently there is a risk of the Probe suffering metal fatigue and cracking. Fatigue failure is more likely if the stress raiser is close to one of the fixed points of maximum mechanical stress in the vibrating Probe. If a Probe does suffer metal fatigue as a result of a stress raiser causing a crack, the Probe will no longer possess a resonant frequency "recognizable" by the Generator and cannot be energized by the generator. Report to the supplier any Transducer with a Probe that has a scratch, if the scratch is deep enough to be detected by sliding a fingernail over it.

## Transducer / Probe Usage

The Cement and Soft tissue Transducers plus the Cement Probes of TORS can be decontaminated and reused. This is an important factor in reducing the cost per case. However, they cannot be reused indefinitely as probes will wear and the piezo crystals in transducers will depolarize over time and so service lifetimes are defined within which optimum performance can be expected. Therefore probes and transducers must be replaced when needed.

The Cement Transducer lifetime is not limited by the system as its usage time is not monitored by the Generator. It should be changed if cutting performance deteriorates. As a guide it may be changed after an average service life of 10 minutes ON-time per case, over 25 cases = 250 minutes ON-time.

All Cement Probes can be used for as long as they continue to soften and remove PMMA effectively as their usage time cannot be monitored by the generator. They should be changed if cutting performance deteriorates. As a guide they may be changed after an average service life of 5 minutes ON-time per case, over 50 cases = 250 minutes ON-time.

For the Soft tissue transducer, every time the Generator energizes the transducer, the duration of the activation is counted by the Generator then written to a memory chip inside every Soft Tissue Transducer, overwriting the previous total. When the total activation time reaches pre-set limit for warning or termination, the TORS will alert the user.

The Soft Tissue Transducer can be used until a total activation time of 25 procedures or 250 minutes of ON-time is reached. The lifetime is checked at boot time and during use by the Generator. After the lifetime limit is reached a warning message is displayed upon the Generator's screen.

## Storage of Equipment between Cases

It is recommended that the Transducers (with associated cables) are stored, between cases, in a large autoclave tray provided and again, care should be taken to ensure that the cables are not kinked close to the connector.

## Maintenance

The hospital is responsible for ensuring that the unit has an electrical safety check performed by qualified service personnel at least once a year.

Do not remove the covers from TORS.

TORS generator does not require periodic calibration. If the Generator detects an internal problem it will display a "Service Due" on the rear LCD. If this is seen, contact RSL to arrange repair.

There are no user-serviceable parts in TORS.

Any damage to the Transducers or cables should be reported and the components returned to the supplier at the earliest opportunity.









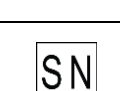
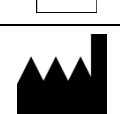

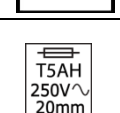
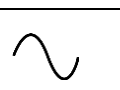

## Technical Support









In line with the Company's policy of quality assurance and customer care, RSL Ltd. offers a telephone helpline service for users of TORS. This is provided by the TORS manufacturer, RSL Ltd at its facility in Devon, England.

HELPLINE Telephone No. as displayed on the unit is: +44 (0)1364 653899

**APPENDICES**

**Appendix 1: Markings on the TORS front and back panels**

	Cement transducer selected
	Soft tissue transducer selected
	Cement transducer output - Channel 1
	Cement transducer output – Channel 2
	Soft tissue transducer output – Channel 3 (low power)
	Soft tissue transducer output – Channel 3 (high power)
	Transducer active
	Model number
	Serial number
	Manufacturer
	Date of manufacture
	FUSE rating – Time delay, 5A, High breaking capacity, 250 Volts AC, size 20mm
100-240V	Mains AC voltage range
	Alternating current
50/60Hz	Mains AC frequency
200VA	Input power
	Warning sign

	Type BF equipment
36kHz	Cement frequency of output
<70W	Cement output power
<b>For Intermittent Use ON/OFF 20/20s</b>	Cement duty cycle
36kHz	Soft tissue frequency of output
<50W	Soft tissue output power
<b>For Intermittent Use ON/OFF 3/30s</b>	Soft tissue duty cycle
	Volume
	Footswitch connection
	Equipotential connection
	Output channel
	Follow instructions for use
	Electrical and Electronic equipment. Return waste to a collection system or treatment and recycling facilities. Follow decontamination instructions before returning waste.
	General caution sign

## Appendix 2: TORS (Series 1) Parts List

ITEM	Product Code
Cement Axial Grip Handpiece (Single Use)	T1AH
Cement 100 Ø6 Piercer Probe (Reusable)	P6R1
Cement 100 Ø8 Piercer Probe (Reusable)	P8R1
Cement 100 Ø6 Scraper Probe (Reusable)	S6R1
Cement 100 Ø8 Scraper Probe (Reusable)	S8R1
Cement 200 Ø4 Piercer Probe (Reusable)	P4R2
Cement 200 Ø6 Piercer Probe (Reusable)	P6R2
Cement 200 Ø8 Piercer Probe (Reusable)	P8R2
Cement 200 Ø10 Piercer Probe (Reusable)	P10R2
Cement 200 Ø6 Scraper Probe (Reusable)	S6R2
Cement 200 Ø8 Scraper Probe (Reusable)	S8R2
Cement 200 Ø10 Scraper Probe (Reusable)	S10R2
Cement Probe Extension Bar - Straight (Reusable)	ESR1
Cement Probe Extension Bar - Curved (Reusable)	ECR1
Soft Tissue Transducer + Probe (Reusable)	T1TT
Cement Transducer (Reusable)	T1CT
Cement Cable (Reusable)	T1CC
Generator	T1G
Mains Cable	934
Generator Carry Case	T1GC
Cement Footswitch	T1FC
Soft Tissue Footswitch	T1FT
Autoclave Tray	T1AT
Autoclave Tray Mat	T1SM
Instrument Carry Case	T1IC
Spanner	T1S
Probe Cleaning Cell	T1CW

### Optional Extras

Generator Cart	T1C
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## Appendix 3: Electromagnetic Interference


### Table 1

<b>Guidance and manufacturer's declaration – electromagnetic emissions</b>			
TORS T1G is intended for use in the electromagnetic environment specified below. The customer or the user of TORS should assure that it is used in such an environment.			
Emissions Test	Compliance	Electromagnetic environment - guidance	
RF emissions CISPR 11	Group 1	TORS uses RF energy only for its internal function. Therefore its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.  TORS is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.	
RF emissions CISPR 11	Class A		
Harmonic emissions IEC 61000-3-2	No testing – not connection to public mains network		
Voltage fluctuations /flicker emissions IEC 61000-3-3	No testing – not connection to public mains network		

### Table 2

<b>Guidance and manufacturer's declaration – electromagnetic immunity</b>			
TORS is intended for use in the electromagnetic environment specified below. The customer or the user of TORS should assure that it is used in such an environment.			
IMMUNITY test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±6 kV contact ±8 kV air (1)	Floors should be conductive. No synthetic material should be used in the environment. The relative humidity should be in the range 40% to 60%.
Electrical fast transient/burst IEC61000-4-4	±2 kV for power supply lines	±2 kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ± 2 kV common mode	±1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0 % $U_T$ <sup>(2)</sup> (100 % dip in $U_T$ ) for 0.5 cycle at: 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°  0 % $U_T$ (100 % dip in $U_T$ ) for 1 cycles  70 % $U_T$ (30 % dip in $U_T$ ) For 25/30 cycles  0 % $U_T$ (100 % interrupt in $U_T$ ) for 250/300 cycles	0 % $U_T$ (100 % dip in $U_T$ ) for 0.5 cycle at: 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°  0 % $U_T$ (100 % dip in $U_T$ ) for 1 cycles  70 % $U_T$ (30 % dip in $U_T$ ) For 25/30 cycles  0 % $U_T$ (100 % interrupt in $U_T$ ) for 250/300 cycles	Mains power quality should be that of a typical commercial or hospital environment. If the user of TORS requires continued operation during power mains interruptions, it is recommended that TORS be powered from an uninterruptible power supply.
Power frequency (50/60 Hz) magnetic field IEC61000-4-8	3 A/m	No testing	No magnetically sensitive components.
<b>NOTES:</b> <i>Mitigation applied because of environment.</i> $U_T$ is the a.c. mains voltage prior to application of the test level.			

**Table 3**

<b>Guidance and manufacturer's declaration – electromagnetic immunity</b>			
TORS is intended for use in the electromagnetic environment specified below. The customer or the user of TORS should assure that it is used in such an environment.			
<b>IMMUNITY test</b>	<b>IEC 60601 test level</b>	<b>Compliance level</b>	<b>Electromagnetic environment - guidance</b>
Conducted RF  IEC 61000-4-6	3V rms  150kHz to 80 MHz  Outside ISM bands	3V rms	Portable and mobile RF communications equipment should be used no closer to any part of TORS, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.  Recommended separation distance  $d = 1.2\sqrt{P}$  $d = 1.2\sqrt{P}$ , 80MHz to 800MHz  $d = 2.3\sqrt{P}$ , 800MHz to 2.3GHz
	6V rms In ISM bands 0.15MHz to 80MHz 80% AM at 1kHz	6V rms	where P is the maximum power output rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).
Radiated RF  IEC 61000-4-3  Immunity to proximity fields from RF wireless communications equipment	3 V/m 80MHz to 2.5GHz	3 V/m	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, <sup>a</sup> should be less than the compliance level in each frequency range. <sup>b</sup>
	9 V/m 710MHz, 745MHz, 780MHz, 5240MHz, 5500MHz, 5785MHz	9V/m	Interference may occur in the vicinity of equipment marked with the following symbol.
	27 V/m 385MHz  28 V/m 450MHz, 810MHz, 870MHz, 930MHz, 1720MHz, 1845MHz, 1970MHz, 2450MHz	27V/m  28V/m	
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
<i>a Field strength from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the in the location in which TORS is used exceed the applicable RF compliance level above, TORS should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating TORS.</i>			
<i>b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m</i>			

**Table 4**

<b>Recommended separation distances between portable and mobile RF communications equipment and TORS</b>			
TORS is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of TORS can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment and TORS as recommended below, according to the maximum output power of the communications equipment.			
<b>Rated maximum output power of transmitter</b>	<b>Separation distance according to frequency of transmitter</b>		
	<b>m</b>		
	<b>150 kHz to 80 MHz</b>	<b>80 MHz to 800 MHz</b>	<b>800MHz to 2.5 GHz</b>
	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance <i>d</i> in metres ( <i>m</i> ) can be estimated using the equation applicable to the frequency of the transmitter, where <i>P</i> is the maximum output power rating of the transmitter in watts ( <i>W</i> ) according to the transmitter manufacturer.			
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

#### Appendix 4: Tones and Beeps

Rising flourish	TORS is booting to standby mode
No Tone	TORS is in standby mode
Triple tone – low-medium-low pitch	Handpiece activate button has been pressed to initialize handpiece (Cement) Handpiece toggle button has been pressed to initialize handpiece (Soft Tissue)
Continuous low pitched tone	Acoustic output at the LOW power level
Continuous high pitched tone	Acoustic output at the HIGH power level
Triple tone – low-medium-high pitch	Soft tissue transducer is changing from LOW to HIGH power
Triple tone – high-medium-low pitch	Soft tissue transducer is changing from HIGH to LOW power
Double beep –high>low pitch	The Generator has reset itself after a minor problem such as time-out or over-temperature but the most common event is frequency mis-tuning due to probe over-damping. So generally this tone means:  “Over-loaded probe, reduce pressure and try again”
Triple beep – high>high>high pitch	A more serious problem has been detected

#### Appendix 5: Rear Panel Messages

The LCD on the rear panel will display messages that indicate the status of the equipment. The following table shows the possible displays:

Message	Status	Action required
Radley Scientific Ltd TORS Issue x	Start up message. Shows the Issue number of the software “X”	Now awaiting Transducer to be plugged in
Cement / Soft Tissue Ready	The Toggle switch has been operated and the relevant Transducer is ready to be activated.	Now awaiting use
36500Hz Low Power	Low power is selected ( STT Only ) (via Soft tissue footswitch)	No action required
36500Hz High Power	High power is selected ( STT Only ) (via Soft tissue footswitch)	
36000Hz Cement Active OR Soft Tissue Active	While Transducer is active the top line will show the frequency. After releasing the switch it will display the final running frequency.	No action required
Active Too long Release Switches	The active button has been held on for too long. No output.	Release activate button on handpiece or on Footswitch
Release Switches	Either activate or toggle button (or Footswitches) has been pressed at switch on.	Release activate or toggle button when switching on Generator
Check Transducer Ease Grip and Retry	Transducer has been loaded too heavily	Release switch, then reactivate using less pressure on the jaw
	Transducer is too hot.	Allow Transducer to cool.
Transducer Limit	Transducer is approaching 100% lifetime. Final use. ONLY APPLIES TO T1TT	Replace Transducer after use ONLY APPLIES TO T1TT
Change Tdcr Transducer Limit	Transducer has reached 100% lifetime and must be replaced. ONLY APPLIES TO T1TT	Replace Transducer ONLY APPLIES TO T1TT
Transducer Limit Ready		
Change Transducer Restart	Transducer frequency too low and feedback signal is low.	Switch supply off & on. Replace Transducer if seen 3 times
Transducer Leakage Change Tdcr	Generator has detected voltage on the Transducer.	Switch supply off & on. Replace Transducer if seen 3 times
Frequency Error Service due	The Generator has detected a serious internal problem.	Switch supply off & on. If message seen again Generator requires service.

## Appendix 6: Technical Specification

Model Nos:	See Appendix 2	
Dimensions:	Generator:	340mm (width) x 95mm (height) x 375mm (depth) 13.4" (width) x 3.7" (height) x 13.4" (depth)
Weight:	Generator:	7.6 kg
	Transport case:	13.8 kg (loaded with Generator)
	Transducer:	0.37 kg
Fuse Type:	T5A, 250V, 20mm (2 off)	
Cordset	Contact RSL for recommended type	
Power supply input	100V - 240V, 50/60Hz	
Power consumption	200VA	
Cement Output - Frequency of operation	36kHz	
Cement Output – Power	<70W	
Cement Mode of Operation	Intermittent ON/OFF, 20/20s	
Cement Transducer Classification:	Type BF	
Soft Tissue Output - Frequency of operation	36kHz	
Soft Tissue Output – Power	<50W	
Soft Tissue Mode of Operation	Intermittent ON/OFF, 3/30s	
Soft Tissue Transducer Classification:	Type BF	
Insulation Classification	Generator:	Class 1
Transducer	Titanium, stainless steel, and plastic Autoclavable maximum 50 cycles/	
Environment for Transportation & Storage:	Temperature: -10°C to +50°C Relative humidity: 10% to 90% Atmospheric pressure: 50kPa to 106kPa	
Environment for Use:	Temperature: +10°C to +30°C Relative humidity: 30% to 75% Atmospheric pressure: 81kPa to 106kPa	

RSL Ltd. will make available on request circuit diagrams, component part lists, descriptions, calibration instructions to assist to service personnel in parts repair.

TORS has been designed and built in accordance with ISO 13485: 2016 Quality Assurance standard for medical devices.

CE conformance has been certified and the equipment complies with:

IEC 60601-1:2005 + CORR. 1:2006 + CORR.2:2007 +  
A1:2012  
EN 60601-1:2006 + A11:2011 + A1:2013  
ANSI/AAMI ES60601-1:2005/ (R) 2012

## **Appendix 7: Warranty Statement**

Subject to the terms and conditions listed below, Radley Scientific Ltd. (hereafter called “the Company”) guarantees to replace or repair free of charge any defective parts of TORS notified within the warranty period. This applies to the hardware defined below for the purposes of warranty claims made by any party supplied directly by Company.

See Warranty statement in document *Specification, SKU Codes, Warranty , Ref. T1-SCW*



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