



# Wireless Solutions for Physiological Monitoring

## User Manual for Small Animal Systems



# Important Information

## Disclaimer

Millar believes that information in this user manual is correct at the time of publishing. In the event errors may exist, Millar reserves the right to make changes to future editions without notice to holders of this edition. The reader should consult Millar if errors are suspected. In no event shall Millar be held liable for damages arising out of the use of this document or information contained within. Except as specified below, Millar makes no warranties, express or implied, and specifically disclaims any warranty of the products fitness for a particular purpose.

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**Millar expresses that its products are for research purposes only. They are not designed with components and testing intended for use in medical treatment or diagnosis of humans or animals and doing so may result in serious harm.**

## Warranty

### **Telemeter Warranty**

Millar's comprehensive telemeter warranty guarantees that telemeters will function out-of-box for the first six months after factory shipment. Additionally, Millar provides a sixty (60) day in-animal telemeter warranty following the first implantation within the six month warranty period. Subsequent implantations are outside the warranty. Any telemeter not registered within six months after factory shipment will be out of warranty.

In order to provide the highest level of customer service, **Millar requires all new telemeters to be registered upon the first implantation.** To register the telemeter's in-animal warranty, simply send an email to support@millar.com and include the following:

- Telemeter Model and Serial Number
- Facility Name
- Primary Investigator / Laboratory Head name and phone/email
- Primary lab contact name and phone/email
- Implantation Date

Multiple telemeters can be activated with a single email.

For complete telemeter handling and storage instructions, refer to this manual.

### **Telemetry Hardware Warranty**

Millar warrants that at the time of sale to the original Purchaser, the telemetry hardware (excluding telemeters – see above) shall be free from defects in materials and workmanship for a period of one (1) years from its date of shipment to the original purchaser. If there is such a defect, Millar will, at no charge and at its option, either repair or replace the equipment as appropriate.

Should the hardware become damaged after expiration of the one year warranty, Millar will accept the product for a no charge evaluation with a signed RMA (return material authorization). If repairs are required, Millar will provide a detailed quote and lead time for the repair process. Repair work will not commence until approval is received from the customer.

As part of Millar's continued commitment to customer support, free online, phone and email support in the use of all telemetry equipment is available beyond all warranty periods.

The warranties above do not cover damage caused by failure to follow instructions for use, owner's abuse, misuse or negligence, user tampering or modifications, power failures or surges and events or accidents considered force majeure such as flooding, fire, etc. outside the reasonable control of Millar. In no case shall liability exceed the purchase price of the original product.

Millar provides free product evaluations during the warranty period and free return to customer shipment. All returned products should be packed safely, preferably in original packaging and shipped to Millar with the RMA number visible on the packaging. In order to receive the highest level of support, the customer is responsible for notifying Millar immediately of a problem within the warranty period. Following product evaluation, Millar will replace or repair (telemeters are non-repairable) any product found to be defective and covered within the warranty period, while operated in accordance with instructions for use and specifications.

For complete product instructions, general insights and surgical recommendations, visit millar.com and access Millar's free online Knowledge Center. <http://millar.com/knowledge-center> Millar is committed to delivering the collaborative support you expect in facilitating scientific insight and advancing medical innovation.

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## To all users;

We pride ourselves on helping you achieve results. If you have any questions related to the operation of your system, please contact us **support@millar.com**

We are here to help.

### Contact Information

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# FCC Compliance

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## Telemeter (TRM54 series)

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.

Note: 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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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/TV technician for help.

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

## TR190 Configurator

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.

Note: 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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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/TV technician for help.

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

## TR181 SmartPad

### Millar Instruments Ltd TR181 SmartPad

#### The Wireless Power Transfer System is FCC Part 18 Compliant

Note: This equipment has been tested and found to comply with part 18 of the FCC limits for non-consumer equipment. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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/TV technician for help.

Note: There is no required maintenance of this device from a FCC compliance perspective.

#### The 2.4GHz Data Transmitter is FCC Part 15 Compliant

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.

Note: 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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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/TV technician for help.

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

# Introduction

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This User Manual contains information relating to the proper installation and basic use of your telemetry system. It is strongly recommended that users visit our online Knowledge Center for more detailed information and to view instructional videos showing implantation, explanation and cleaning techniques. <http://millar.com/knowledge-center>

All small animal telemeters use a unique patented inductive power transfer system for recharging and making long-term recordings in small animals 175 grams and over.

Please note that if your system has been customized in any way parts of this manual may not apply to your system. If you have any questions please contact us at [support@millar.com](mailto:support@millar.com)

## Key Features

### Accuracy:

For long term, high frequency physiological recordings. Digital wireless recording of data with the highest quality signal integrity.

### 24/7:

Data can be collected continuously - 24 hours a day while the animal is on the SmartPad, with no need to replace batteries.

### Versatility:

Telemeters send data wirelessly from within the animal to the SmartPad where it is converted to an analog signal compatible with any data acquisition system.

### Low cost of ownership:

Battery replacement is not required. With user care, telemeters can be re-charged and re-used.

### Efficient housing:

Animal cages can be next to each other in one location for simultaneous data collection from multiple animals. No specialized cages or shielding is required as each telemeter operates digitally using one of 30 independent frequencies with no interference to recordings.

### Service & support:

Millar prides itself on being responsive to our customers' current and future needs. We have experienced engineers and scientists on staff to provide professional, expert and timely support and advice.

# Telemetry System Components

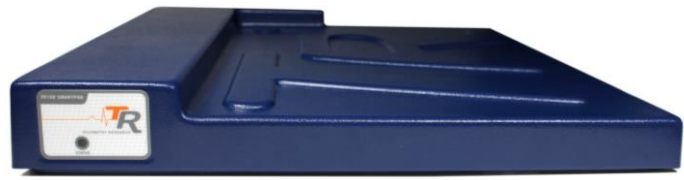
## The Telemeter

*Care must be taken not to damage the telemeter body, catheter or electrodes. Telemeters are not repairable!* Depending on the model, your telemeter may look slightly different to images throughout this manual; however all telemeter models have the same basic construction and operation. All telemeters are shipped individually packaged and sterile ready for use. All telemeters will need to be activated and configured prior to implantation. PLEASE NOTE the telemeter does NOT need to be removed from its packaging for Activation and Configuration.



## The SmartPad

Do not operate the SmartPad on or within 10 cm of a metal surface or within 40 cm above or below another SmartPad or Wireless Power Charger.



## The Configurator System

The Configurator System includes the Configurator hardware and ConfigSoft software. Together they are used to wirelessly control telemeters and SmartPads to:

- Change/configure a telemeter and SmartPad Channel frequency.
- Run and provide diagnostic information about telemeters (such as battery charge) and SmartPads.
- Place telemeters into Safe Mode (for storage).
- Control the charge-field of the SmartPad.

ONLY a single Configurator System is required to control all telemeters and SmartPads in a laboratory. The Configurator System is not required for data acquisition.

**\*\* IMPORTANT:** The ConfigSoft software supplied on the USB drive must be installed on a PC before connecting the Configurator hardware to the computer.





# Quick Start Guide for Small Animal Systems



## 1. Install Configurator software prior to connecting to computer

System requirements; Windows XP, Vista (32bit) or 7 (32 bit, 64 bit) and USB 2.0 port.  
Windows 8 and USB 3.0 are not supported.  
Internet access is required to install all drivers.  
Insert USB drive and run ConfigSoft setup.



## 2. Configurator Setup



The Configurator enables users to set the transmission channel of Telemeters and SmartPads. The Configurator wirelessly communicates to the Telemeter and SmartPad.

1. Attach aerial to rear of the blue Configurator case.
2. Connect Configurator to computer via USB cable.

## 3. SmartPad Setup

The SmartPad acts as a universal inductive recharging platform and receiving station for all small animal Telemeters (TR5\* series).

- A. Plug in power
- B. Light on front will turn on (initially solid orange)

*Do not operate SmartPad within 10cm of a metal surface.*



## 4. Activation of Telemeters

- A. Do not open the Telemeters from their sterile packaging.
- B. Place only one Telemeter package on the SmartPad (ensure any other Telemeters are 2 meters away).
- C. The SmartPad will turn the Telemeter into active mode and will start transmitting data.

A green LED on the front of the SmartPad indicates that it has identified a Telemeter on the same channel.  
An orange LED indicates no Telemeter could be found on that channel.  
ONLY activate and change the channel number of one Telemeter at a time.



## 5. Pair Telemeters and SmartPads using Configurator software and Configurator

All Telemeters and SmartPads are initially configured to channel "Setup".  
For data collection, select and pair each Telemeter and SmartPad to one of 30 channels.

The Configurator is not required for data acquisition.

## 6. Implant Telemeters

Telemeters are normally shipped sterile and ready to implant.  
Surgical instructional guides and techniques are available online.  
<http://millar.com/knowledge-center>



## 7. Connect SmartPads to data acquisition system

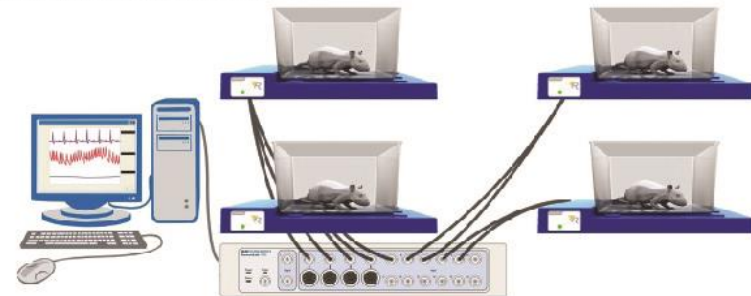
Connect SmartPad to a data acquisition system using the BNC outputs. Each SmartPad has three analog outputs which are automatically set when the Telemeter model has been paired.

**Output Signal Configuration:**

Telemeter model	Output 1	Output 2	Output 3
TRM54P	Pressure	Unused	Temperature
TRM54PB	Pressure	Biopotential	Temperature
TRM54PP	Pressure	Pressure	Temperature
TR50B	Unused	Biopotential	Temperature
TR50BB	Biopotential 1(yellow & green)	Biopotential 2 (black & red)	Temperature
TRM56SP	Pressure	SNA original	Temperature
TR57Y	Oxygen	Unused	Temperature

## 8. Acquire data

When a cage containing the animal is placed on the SmartPad, and charging field is enabled, the Telemeter will be activated and data transmission will occur. Continuous data collection and simultaneous charging is now possible.



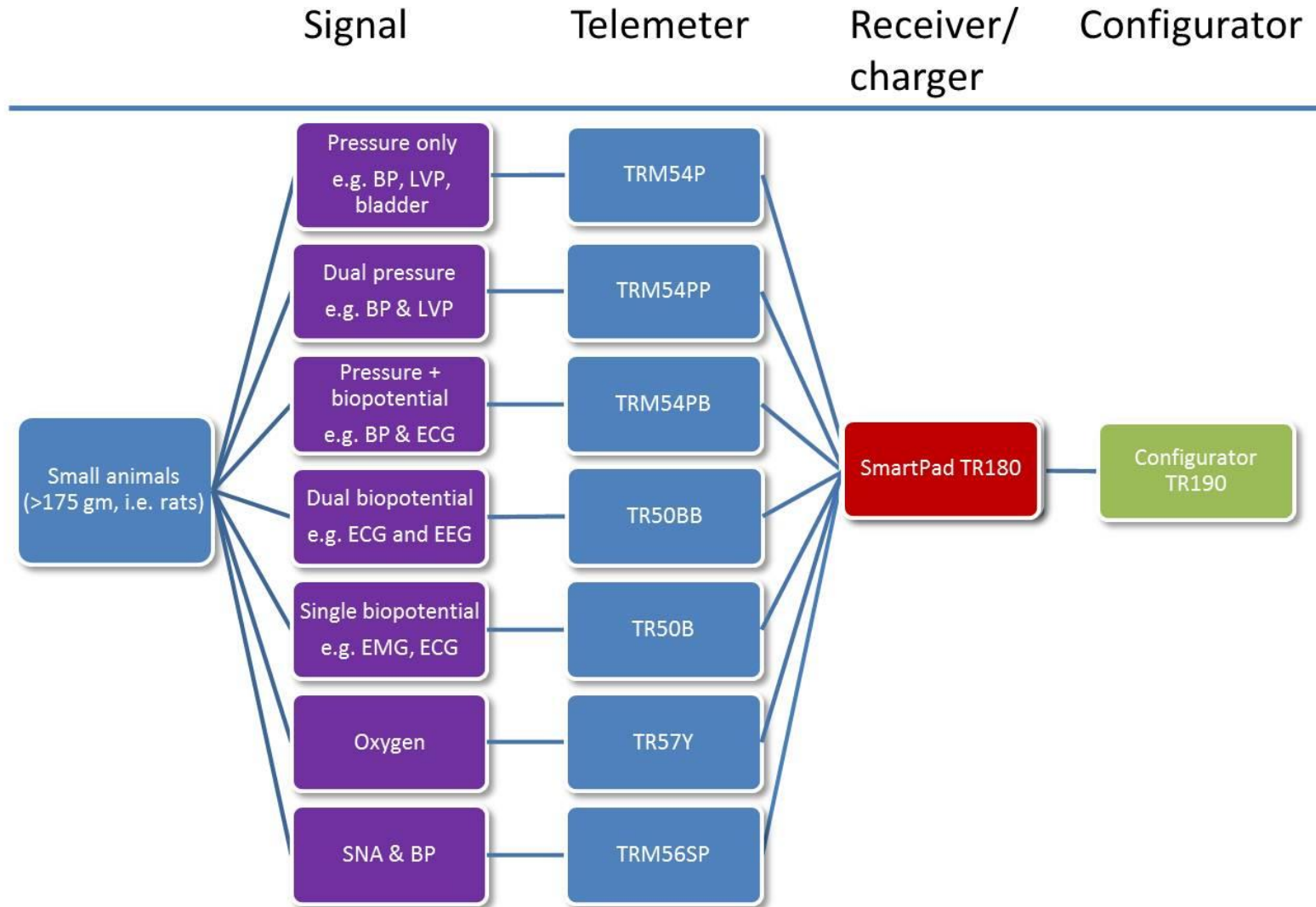
## 9. Storage of Telemeters

Telemeters are fragile and cannot be refurbished if damaged, always store them in the containers provided. Use ConfigSoft to place Telemeters into Safe Mode for storage or when animals are away from the SmartPad for extended periods. Always fully charge the battery prior to storage.

## 10. Questions/support?

support@millar.com or visit:  
[www.millar.com/knowledge-center](http://www.millar.com/knowledge-center)

# Small animal systems



# Configurator System Setup

## Introduction

The Configurator System (Configurator hardware and ConfigSoft), wirelessly communicates with all telemeters and SmartPads. The system allows the user to:

- 1) Change/configure Channel frequencies.
- 2) Turn telemeters into Safe Mode for storage.
- 3) Check telemeter battery level.
- 4) Enable or disable the charging field of the SmartPad.
- 5) Run telemeter and SmartPad Diagnostics.

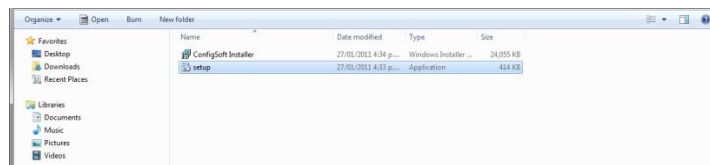
Only a single Configurator System is required for each laboratory and is NOT required for data acquisition.

## Configurator Software Installation

**NOTE:** ConfigSoft must be installed on the PC before connecting the Configurator hardware. *System requirements; Windows XP, Vista (32 bit) or 7 (32 & 64 bit) and USB 2.0 port (Windows 8 and USB 3.0 are not supported).* Internet connection is necessary to access and install any drivers not already installed.

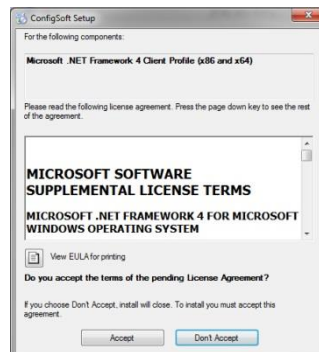


- 1) Insert the supplied USB drive containing ConfigSoft into a PC USB port.
- 2) Open the folder "ConfigSoft".
- 3) Double click on "setup" to start the installation.

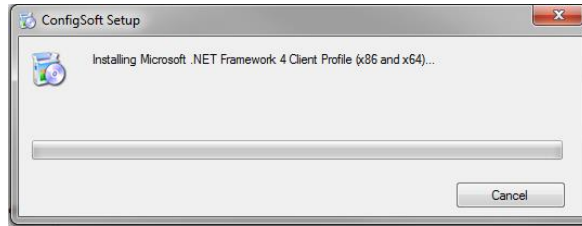


Depending on the files and drivers already installed on your computer some of the following steps may not be necessary.

- 4) Accept the license agreement for .NET Framework.



- 5) The Microsoft .NET Framework will be downloaded from the internet if not already installed (this may take some time). Follow all instructions to complete the installation.

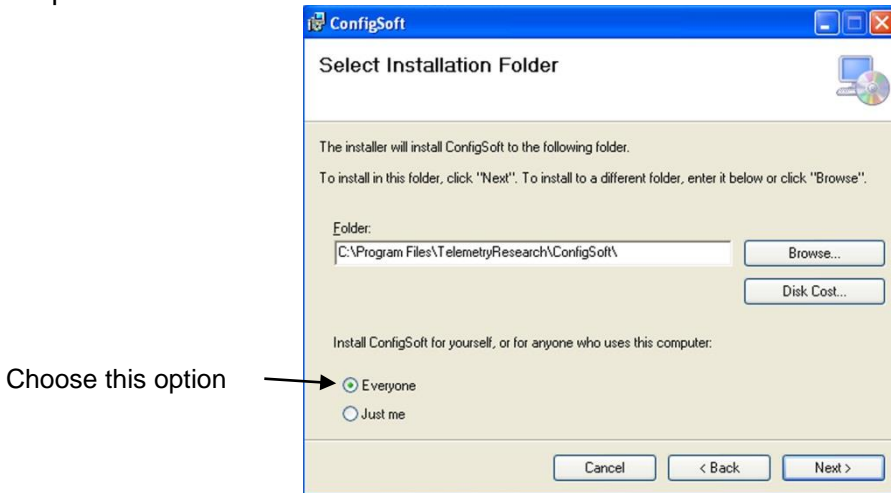


- 6) Follow the instructions for installing ConfigSoft. Click Next.

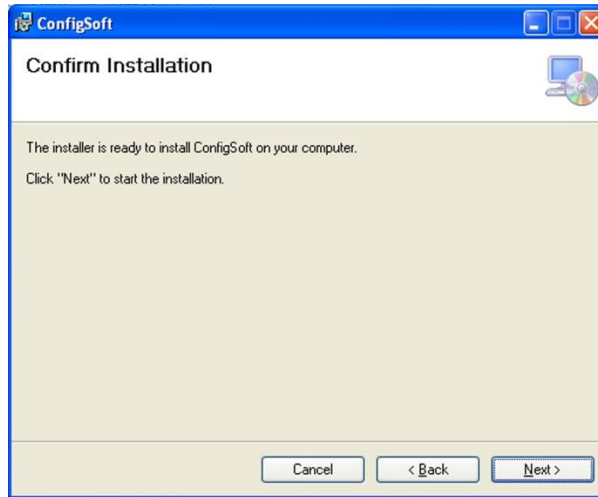


- 7) Click Next to use the default folder or choose another folder to install ConfigSoft.

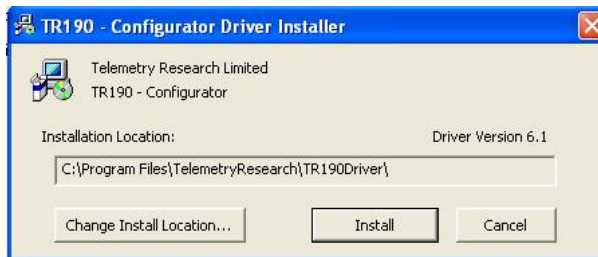
Note: We suggest that you choose the option to install ConfigSoft for anyone who uses this computer.



- 8) Confirm installation. Click Next



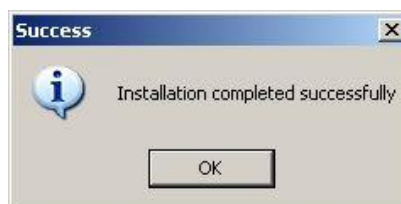
- 9) Install the Driver for the TR190 Configurator. Click Install.



- 10) Ignore the software Windows Logo warning. ConfigSoft and drivers are safe to install. Do not hit the Enter key but make sure to Click "Continue Anyway".

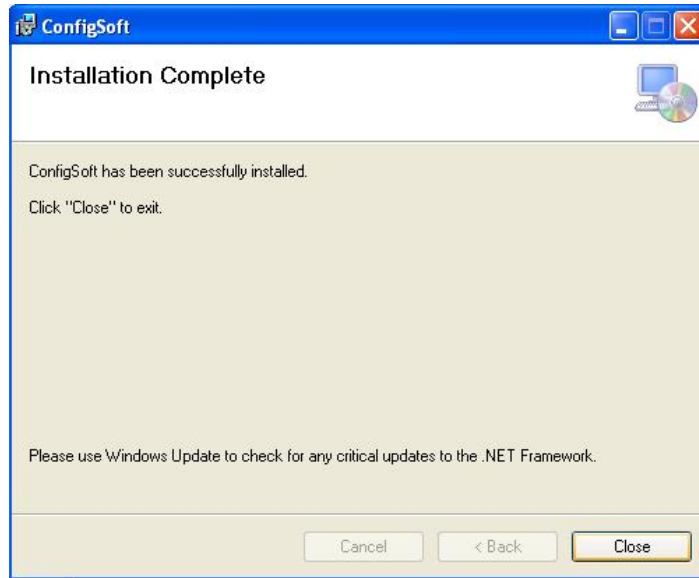


- 11) Success: Click OK

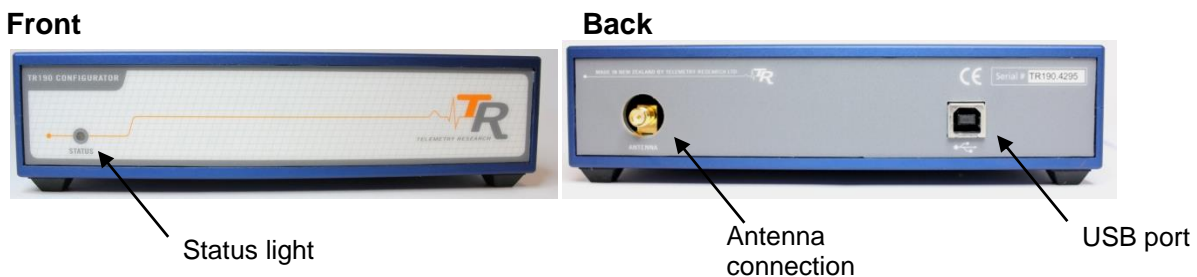




12) ConfigSoft is now installed. Click Close



## Connecting the Configurator



- 1) Attach the antenna to the back of the Configurator.
- 2) After installation of the software ConfigSoft, connect the Configurator to your PC using the supplied USB cable. The status light on the front of the Configurator should glow **red** indicating that it is receiving power from the PC.

The status light (front) on the Configurator indicates the following information:

- |       |   |
|-------|---|
| Off   | Not connected, USB cable unplugged Configurator is off        |
| Red   | Configurator is receiving power but not communicating with PC |
| Green | Configurator is communicating with the PC                     |

- 3) The PC will open the “Found New Hardware” Wizard window. Choose the “No, not this time” option and click Next.



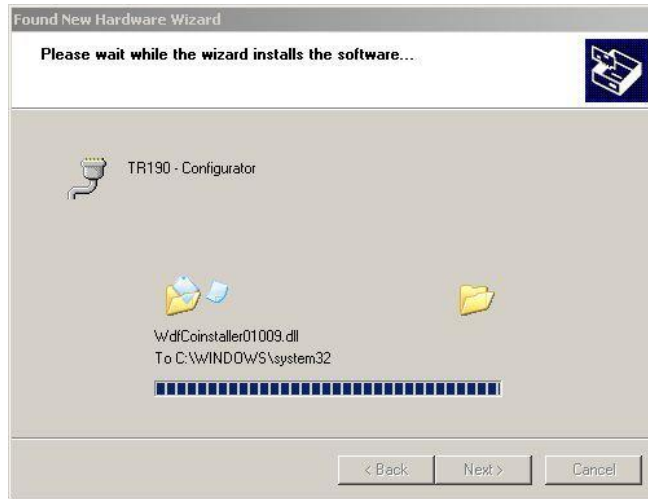
- 4) Click Next to install the driver automatically.



- 5) Ignore the driver signing warning. Configurator drivers are safe to install. Click “Continue Anyway”.



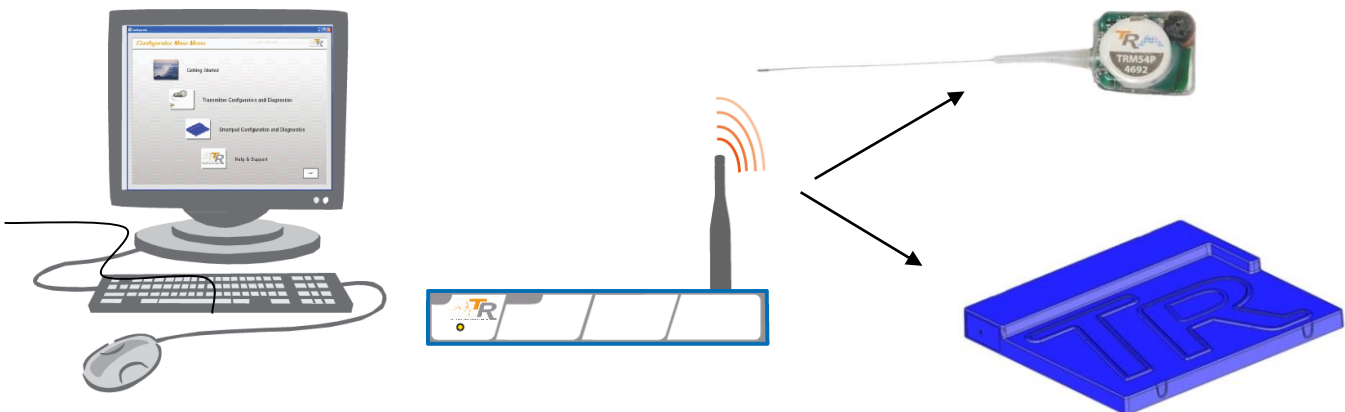
6) The driver may take a few moments to install.



7) If successful the Status light on the front of the Configurator should now be **green** indicating that it is communicating with the PC. Click Finish to close the Window.



8) The Configurator System is now ready for use with all your telemeters and SmartPads.



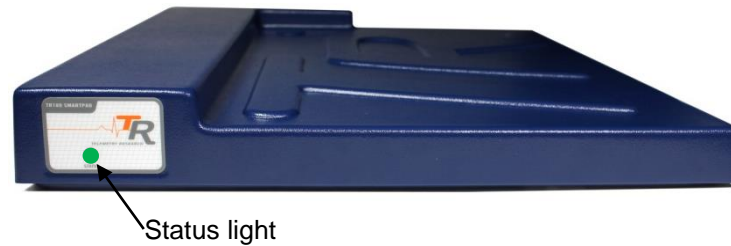


# SmartPad Setup

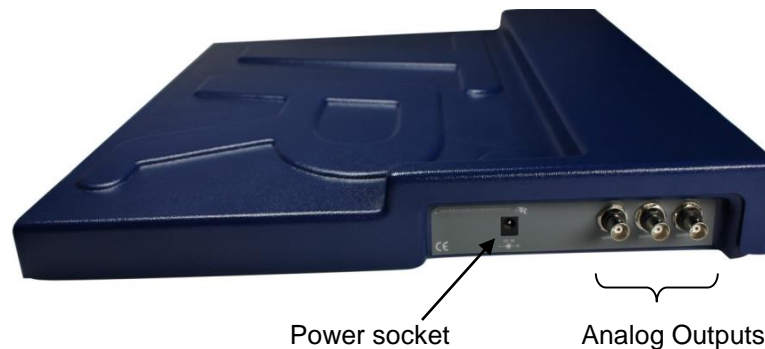
The SmartPad is a receiver and charger in one device. Do not operate a SmartPad near a metal surface (unless the charging field has been disabled using the Configurator System).

All SmartPads are shipped set to Channel "Setup". Before using a SmartPad with a telemeter you need to configure and pair each SmartPad with the same Channel of the telemeter to be used. It is important that only one SmartPad is used on any particular channel or interference will occur.

## Front



## Back



### Status Light information:

Orange	The SmartPad is turned on but is not communicating with a telemeter
Green	The SmartPad is communicating with a telemeter on the same Channel
Flashing orange	The SmartPad is in diagnostic mode. No telemeter data will be output.
Red	The SmartPad has automatically disabled the charging field due to detection of a high current. In this mode data output will continue but battery charging is not occurring. Cause: may be due to the SmartPad being placed too close to a metal surface or to another SmartPad. Move the SmartPad away from any metal and then reset by unplugging the power and plugging it back in (see page 13).

- 1) Connect the supplied Power Supply to the Power Socket on the back of the SmartPad.
- 2) The Status light will be Orange.
- 3) Use the Configurator System to select the Channel to match the telemeter being used.
- 4) Status light will change to Green when SmartPad and telemeter Channel are matched.
- 5) By default the charge field of the SmartPad is enabled, if you need to disable the charge field use the Configurator System.

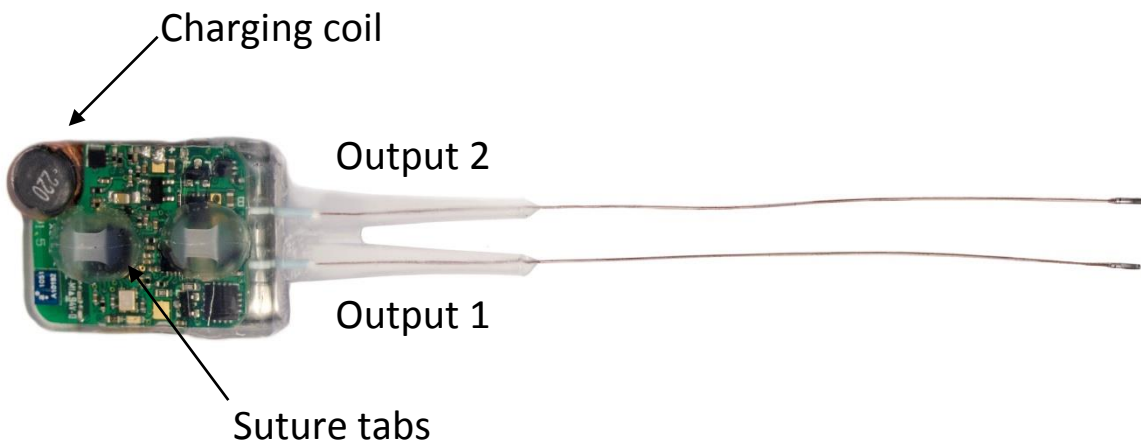
### Analog Outputs

After pairing the SmartPad/telemeter Channels the SmartPad automatically detects the type of telemeter it is communicating with and the analog outputs on the back will correspond to the following signals (all analog outputs are low pass filtered at 1 kHz).

Telemeter model	Output 1	Output 2	Output 3
TRM54P	Pressure	Unused	Temperature
TRM54PB	Pressure	Biopotential	Temperature
TRM54PP	Pressure	Pressure	Temperature
TR50BB	Biopotential 1 (Green/Yellow)	Biopotential 2 (Red/Black)	Temperature
TR50B	Unused	Biopotential	Temperature
TR57Y	Oxygen	Unused	Temperature
TRM56SP	Pressure	SNA	Temperature

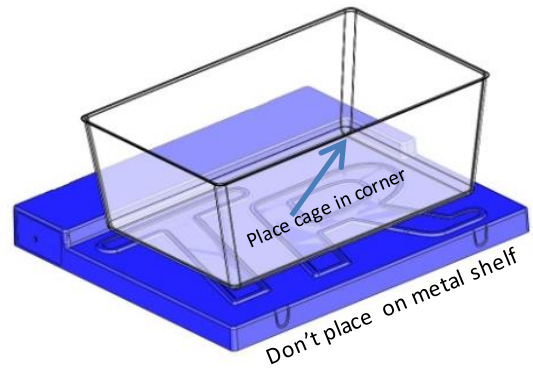
### Dual Pressure Telemeter (TRM54PP) Catheter Outputs

When looking at the TRM54PP dual pressure telemeter with the label facing down (as if the telemeter is placed in the animal), the SmartPad output 1 will correspond to the pressure catheter furthest from the charging coil.



### Cage Positioning on SmartPad

The SmartPad is designed to charge small animal telemeters while they are implanted in the animal. To do this place the animal cage on the SmartPad so that it is against the raised edges in the back left hand corner.

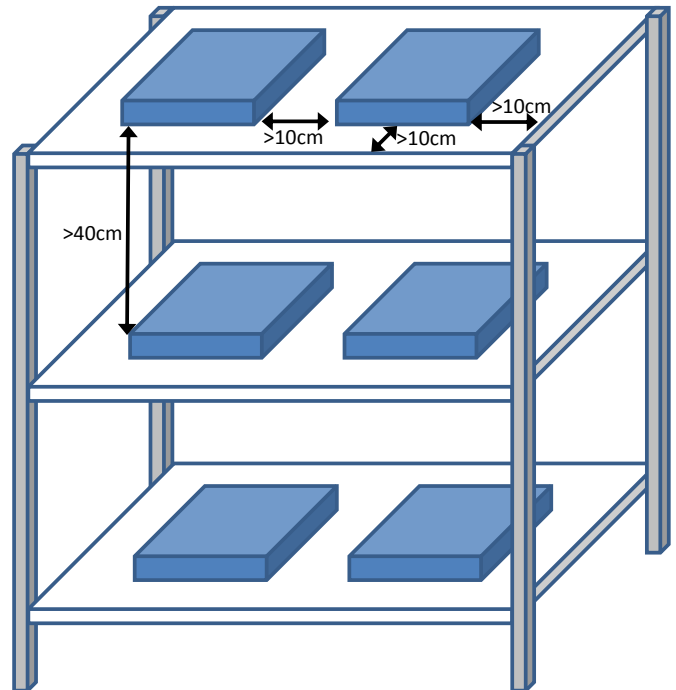


To protect the telemetry battery, the SmartPad automatically controls the strength of the charging field using information from the telemetry. It is important that telemeters are only placed on SmartPads set to the same channel otherwise over or under charging may damage the battery. The Charging field of the SmartPad is also set to cycle automatically and turns off for 30 minutes every two hours, this however does not significantly affect recharging of the telemetry battery.

### Shelving Setup

The SmartPad charges the telemetry using an electromagnetic field generated above and below the SmartPad. For this reason it is important that a SmartPad is NOT placed on a metal surface or above or below other SmartPads (unless 40 cm apart). If the SmartPad is to be used near metal, for data collection only, then the charging field must be disabled using the Configurator System. (Please note that with the field disabled, the telemetry will not recharge and recording time will be limited to 4-6 hours).

Plastic shelving is best for your SmartPads. Arrange your SmartPads so that there is at least 10cm horizontal and 40 cm vertical separation between them. If using shelving that has metal supports or framing then the SmartPads must be >10cm away from these as well (don't forget to check the underside of the shelves for metal supports). There should also be at least 10 cm separation between the top of a metal cage lid and the SmartPad on the shelf above.



If metal shelves are used, while the charging field is enabled, the SmartPad needs to be raised at least 10 cm from the shelf surface but you must maintain a vertical separation of at least 40 cm between SmartPads.

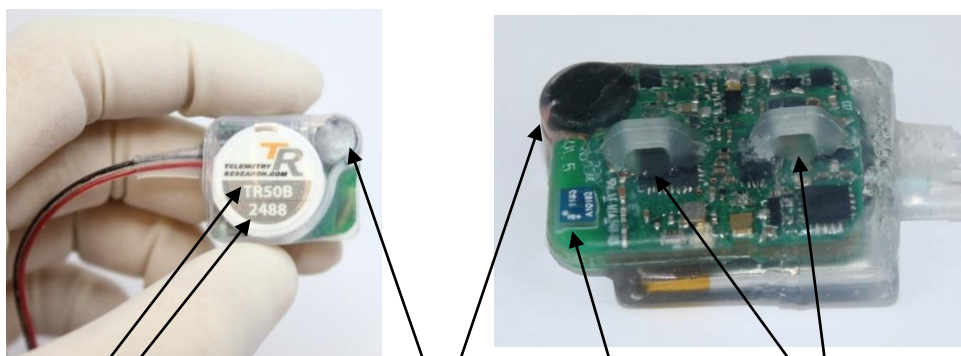
If your SmartPad shows a **red light**, then you need to separate your SmartPads further (vertically and horizontally) and/or move them further away from any metal brackets, supports, cables or power packs. Reset the SmartPad by unplugging the power and plugging it back in. If the problem continues, please contact us [support@millar.com](mailto:support@millar.com)

# The Telemeter

Telemeters are shipped sterile ready for implantation. ALL telemeters are shipped on Channel “Setup” and each telemeter must be configured to one of 30 different channels before use. There is no need to unpack the telemeter from the sterile packaging (see right) to change the channel. **Please note** that the communication channels of the current telemeters and SmartPads are the same as the old model telemeters, receivers or wireless power chargers (pre 2011). Any other devices on the same channel will interfere with SmartPad communication.



The telemeters are fragile electronic devices. *Care must be taken not to damage the telemeter body, catheter or electrode as they cannot be repaired.* Please read the section about Handling and Care of your telemeters. Depending on the model, your telemeters may look slightly different to those pictured throughout the manual; however their care, handling, preparation and use are the same.



Model number  
Serial number

Charging coil

Antenna

Suture tabs

## Pressure Sensor

Telemeter models that include pressure measurement are fitted with a solid state pressure sensor from Millar. The sensor is at the end of the catheter (see below) allowing highly accurate measurement of pressure signals directly where the tip is located. The sensing tip should be handled carefully. Never lift the telemeter by the tip, pierce the tip with a sharp object or hit the tip against a hard surface.



## Temperature measurement

All telemeters record temperature. When collecting temperature data from the telemeter at the same time as charging, temperature output from the SmartPad is updated once every two hours. Continuous temperature measurement is available if the SmartPad charging field is disabled (see page 21).

## Telemeter Storage and Battery Charge

If a telemeter is to be stored for any length of time it is recommended that the telemeter be turned on and the battery level checked. If the telemeter has not been used for up to 6 months it should be turned on and the battery checked using the Configurator System. After turning on the telemeter, the battery should be checked using the Configurator system and while it is away from the charge field of the SmartPad. Before placing the telemeter back into Safe Mode it should be fully charged (90-100%).

# Configurator Software - Overview

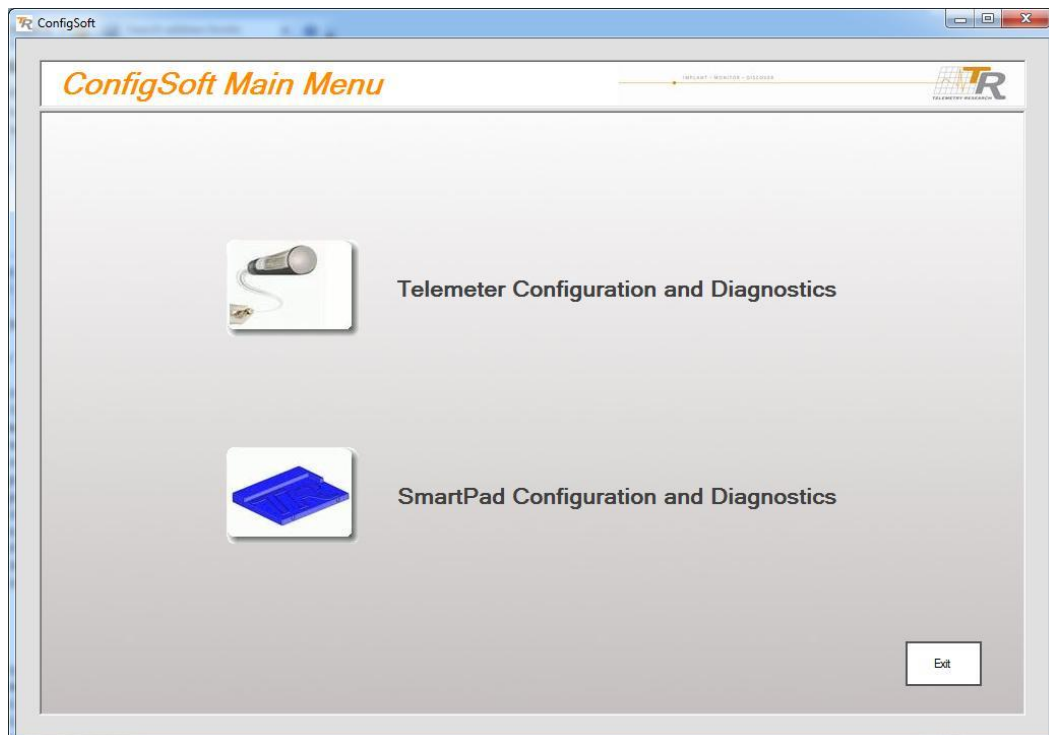
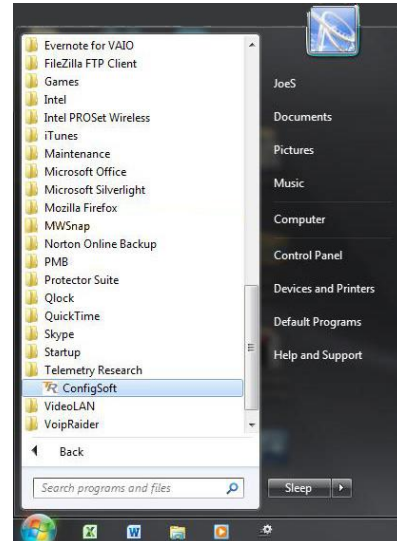
ConfigSoft can be started from either the

- Desktop icon



OR

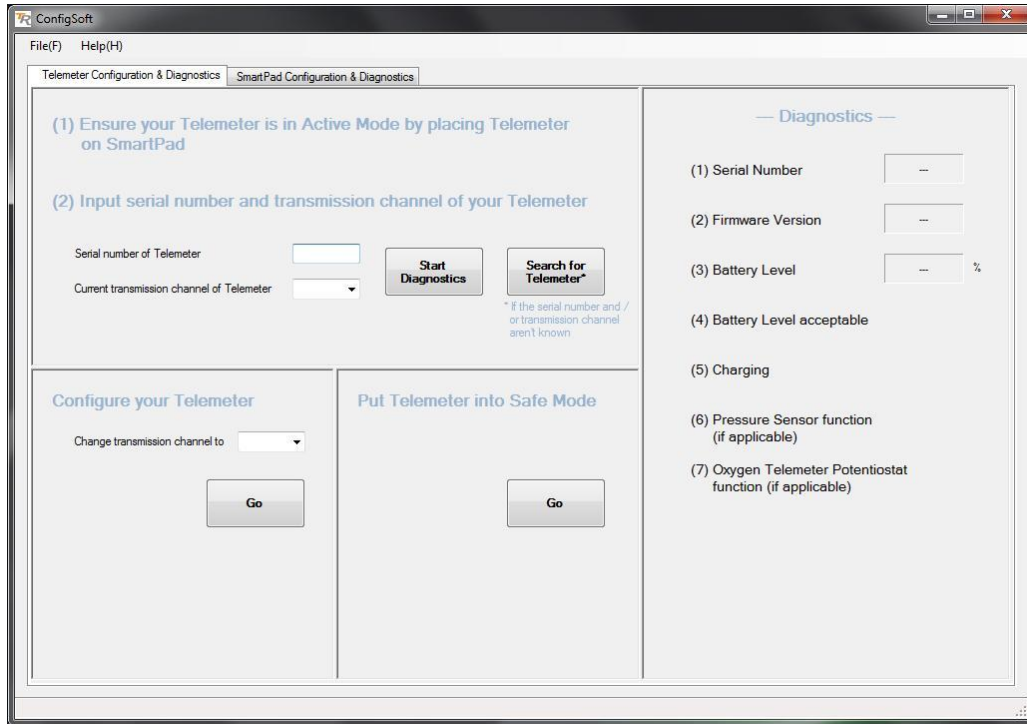
- Start>Programs>Telemetry Research>ConfigSoft



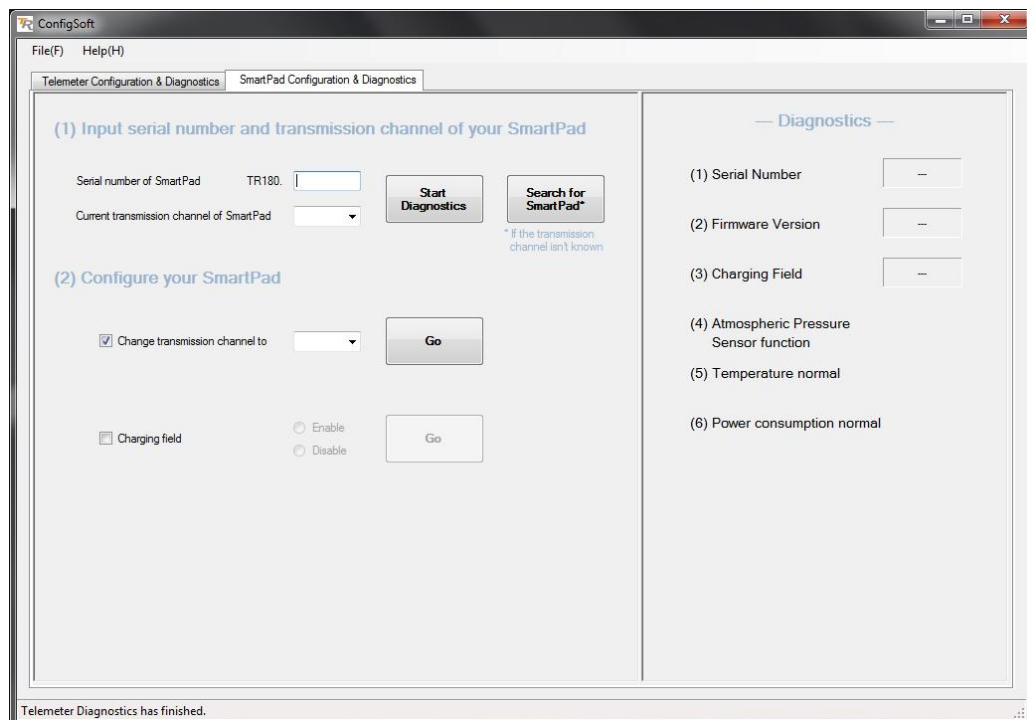
From the main menu the user has access to the:

1. Telemeter Configuration and Diagnostics
2. SmartPad Configuration and Diagnostics

## Telemeter Configuration and Diagnostics Dialog



## SmartPad Configuration and Diagnostics Dialog

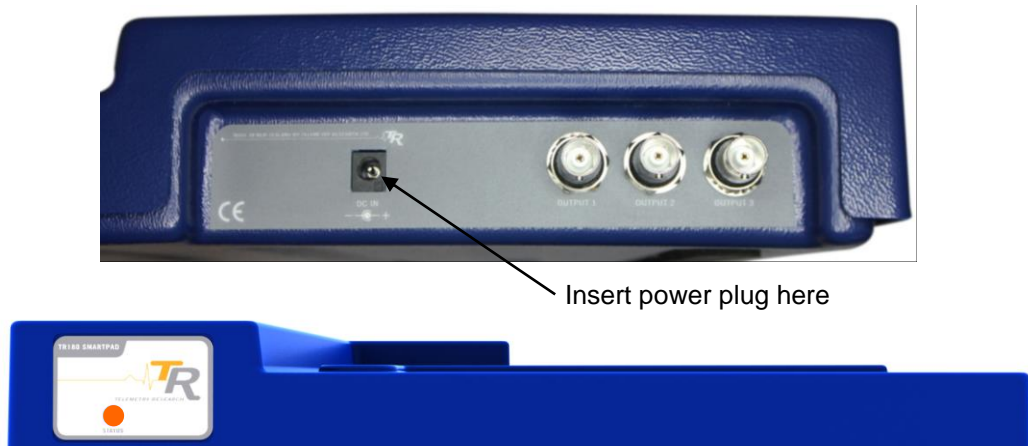




# Pairing a SmartPad and Telemeter

Before implanting a telemeter into an animal, a SmartPad and telemeter need to have their Channels paired. Please ensure that only **one** SmartPad and **one** telemeter are configured and paired at any one time. All SmartPads and telemeters are shipped on Channel “**Setup**” as default. **When pairing a telemeter/SmartPad make sure any other SmartPads (on the same Channel) are turned off until needed and any other telemeters (on the same Channel) are in Safe Mode and remain at least 2m away from any active SmartPad.**

- 1) Turn on the SmartPad (Status light should be **orange**).



- 2) Place a telemeter (still in its sterile packaging) on the SmartPad. This will automatically turn the telemeter into Active Mode (data transmission active).
- 3) If the Status light on the front of the SmartPad glows **green** then the telemeter and SmartPad are on the same Channel, and paired for data collection.

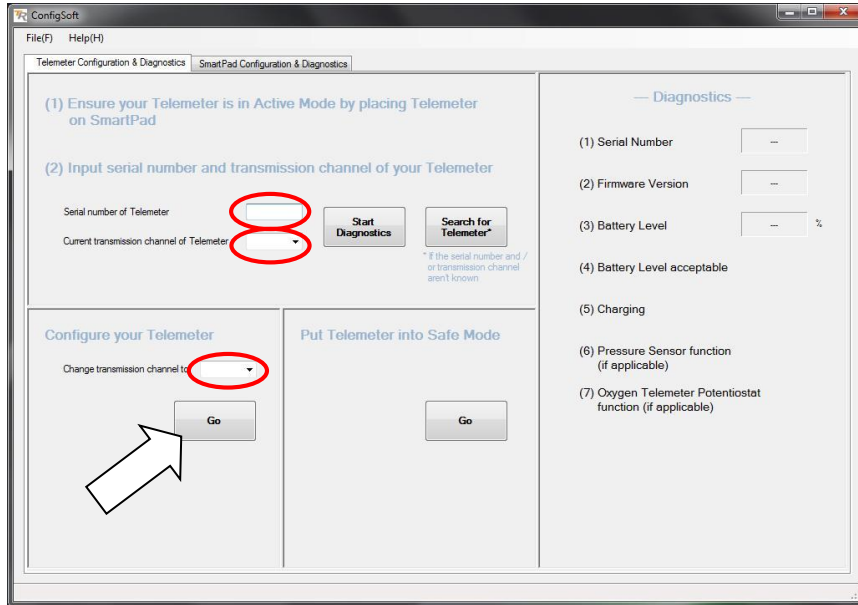


If the SmartPad Status remains orange the SmartPad and/or telemeter need to have their Channels changed/paired using the Configurator System.

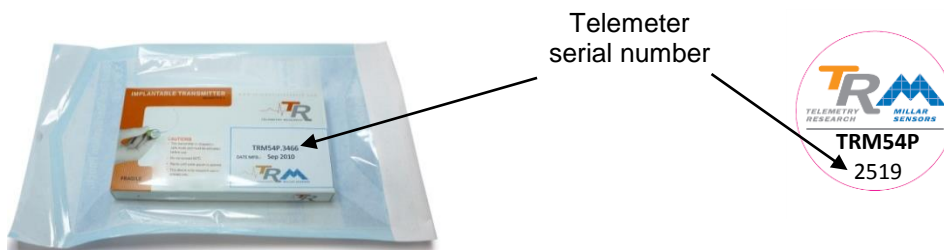
## **Changing Telemeter Channel**

- 1) After activating remove the telemeter from the SmartPad and place it 1m away from the SmartPad.
- 2) Open ConfigSoft
- 3) Click on “Telemeter Configuration and Diagnostics”

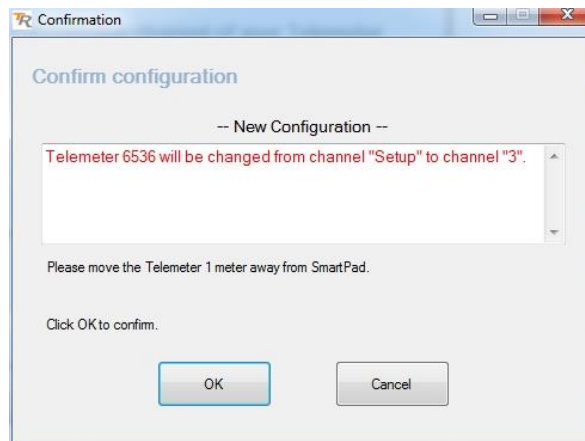
## Telemeter Configuration



- 4) Enter the serial number of the telemeter. The number is on the outside of the telemeter box or on the round label on the telemeter under the model number.

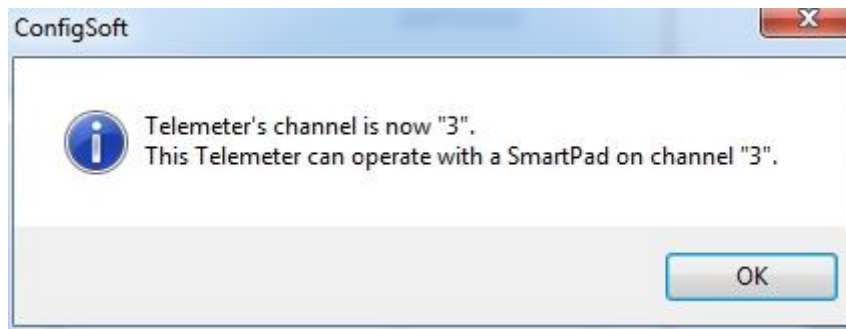


- 5) Select or enter the current Channel number of the telemeter (first use: Channel "Setup").
- 6) To change the Channel number, select or enter the new Channel number in "Configure your Telemeter".
- 7) Click Go to activate the new Channel.



- 8) Click OK to confirm the choice.



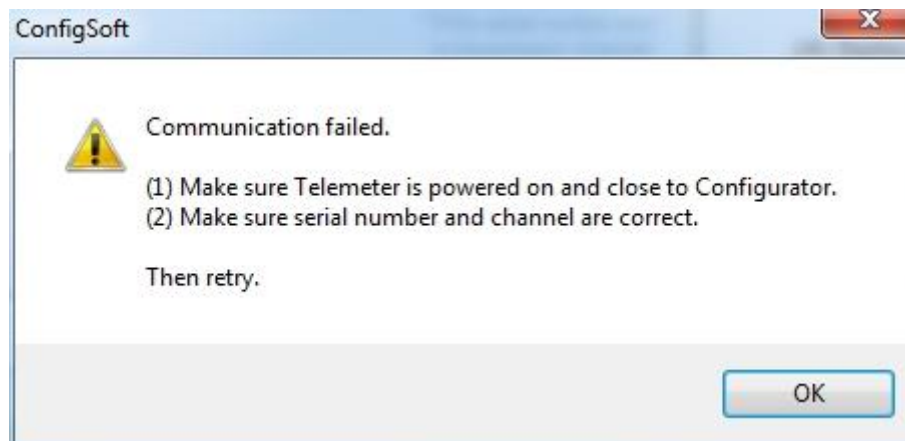


- 9) A message confirming the new telemeter Channel should appear. To make it easier for the future, record the telemeter Serial number and Channel number for all telemeter configurations.

If using a SmartPad with a Channel other than 3, as in this example the Status light will become orange. To change the SmartPad Channel see page 19: SmartPad Configuration.

**Troubleshooting: Configurator - Telemeter**

If the Configurator cannot communicate with the telemeter an error message will appear.

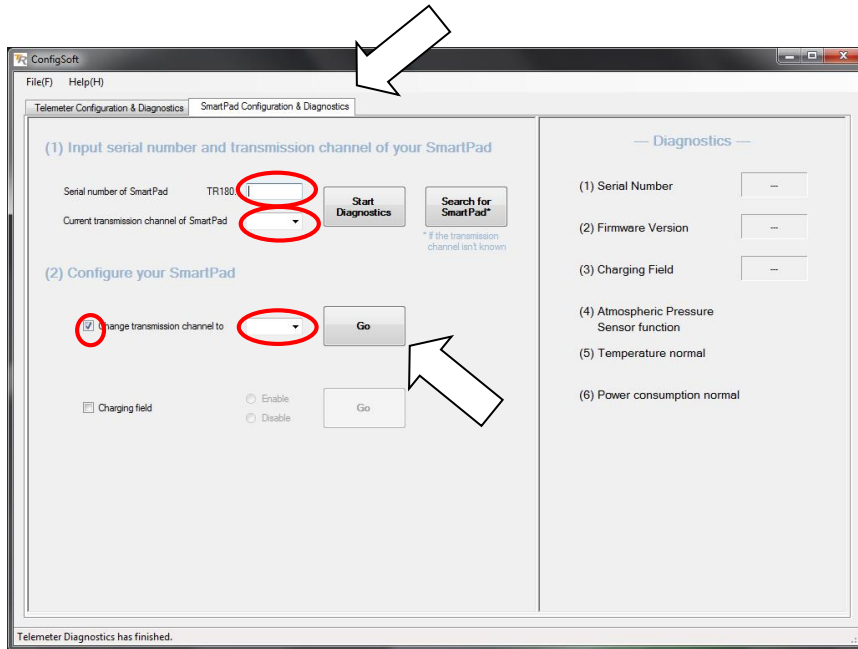


**Solution:** Do the following and try again

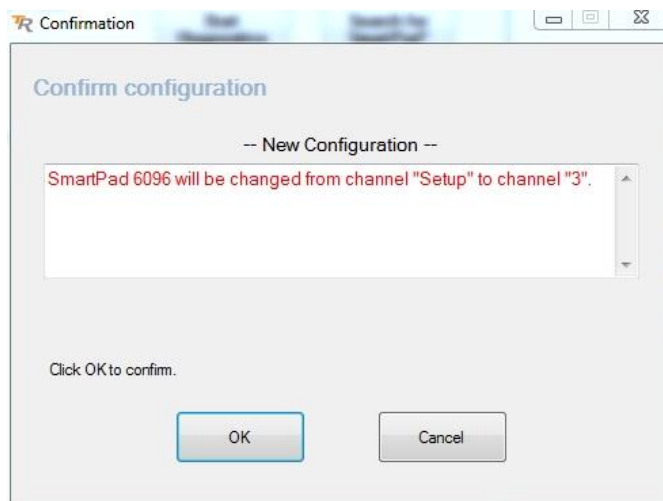
- Check that you have entered the correct telemeter Serial number.
- Check that you have entered the correct telemeter Channel number.
- Move the telemeter closer to the Configurator.
- Check the telemeter is not on an active SmartPad.
- Move other telemeters away.

## SmartPad Configuration

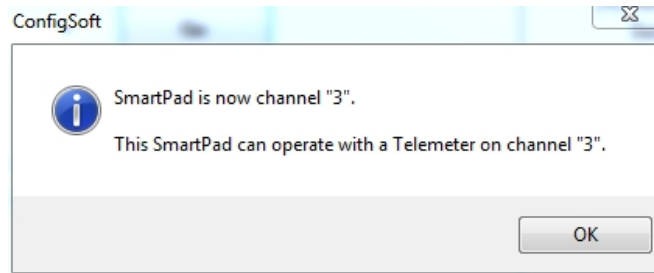
- 1) To change the SmartPad to work on the same Channel as a known telemeter, click on “SmartPad Configuration and Diagnostics” Tab.



- 2) Enter the serial number of the SmartPad (found on the front and back of the SmartPad).
- 3) Enter current Channel number of the SmartPad (first use: Channel “Setup”).
- 4) Enter or select a new Channel number for the SmartPad (should be same as telemeter being used).
- 5) Ensure “Change transmission channel to” is checked.
- 6) Click Go to activate the new Channel.
- 7) Click OK to confirm your choice.

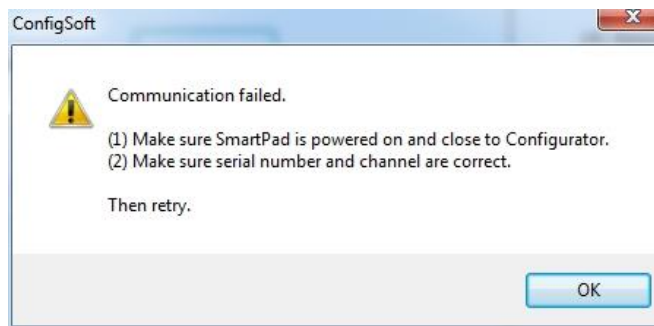


- 8) A message confirming that the SmartPad channel has been changed will appear. Record the SmartPad serial number and new Channel number for future reference.



- 9) If using a telemeter on Channel 3, in this example, the SmartPad Status light should change to green. The telemeter and SmartPad are now on the same Channel, paired, and able to communicate for data collection and transmission.

If the Configurator cannot communicate with the SmartPad you will get the following error message.



Click OK and perform the following then retry:

- Check that the light on the front of the SmartPad is glowing either orange or green.
- Check that you entered the correct Serial and/or Channel numbers.
- Move SmartPad closer to Configurator.

The telemeter is now in Active Mode and sending data. The battery life in this mode is continuous if on a SmartPad or 4-6 hours away from a SmartPad (dependent on telemeter type and fully charged status). If data collected is not required immediately, we recommend you remove the telemeter from the SmartPad and place it into Safe Mode using the Configurator System.

Repeat the above process for each of the SmartPads and telemeters to configure each pair to a different Channel.

Your telemetry system is now configured and ready for use.

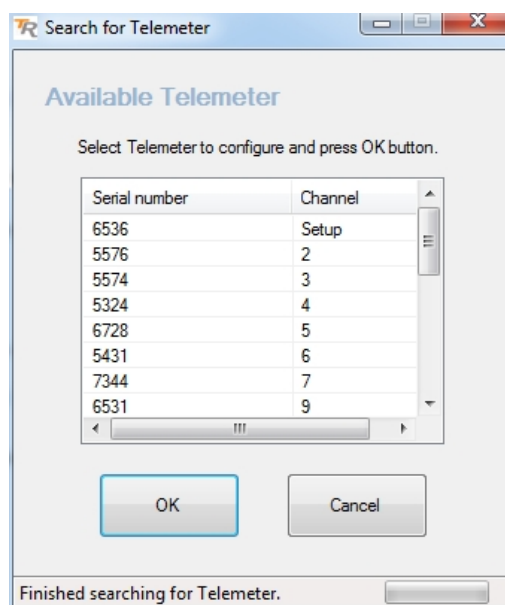
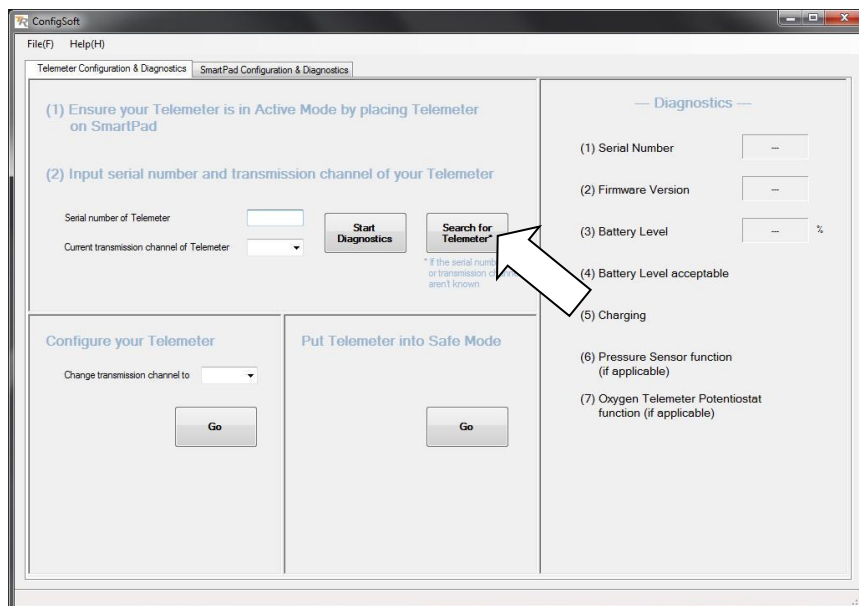
### Charging field

The Charging field option in the SmartPad Configuration and Diagnostics Dialog allows the user to enable (turn on) or disable (turn off) the charge field of the SmartPad. By default when the SmartPad is powered the charge field will be turned on. Turning the charge field off may be useful if recording from an animal while it is in an experimental chamber, running wheel, water maze etc where the SmartPad will be near metal. The telemeter battery will not charge when placed on a SmartPad with the field disabled so data collection will only be possible for approximately 4 continuous hours. After this time, the telemeter will need to be placed on a SmartPad with the field enabled for a minimum of 5 hours.

## Troubleshooting and frequently asked questions

### *What if I do not know the Channel setting of the telemeter?*

With the telemeter in Active mode press the “Search for Telemeter” button on the *Telemeter Configuration & Diagnostics* dialog of ConfigSoft. The Configurator will search through each of the available channels and report any telemeters which are in Active Mode and within range and report the serial number and Channel.



### *What if I do not know the serial number of a telemeter already implanted in an animal?*

It is always best to record the telemeter serial number and Channel at the time of surgery, however if you do not know the Channel or the serial number of the telemeter use the “Search for Telemeter” in ConfigSoft and use a process of elimination. The Configurator will search through each of the channels and report any telemeters active and within range. If you have more than one unknown telemeter move any other telemeters out of the detection area (more than 5m away).

*The Search for Telemeter function does not find the telemeter. What do I do now?*

There are 4 possible explanations:

- 1) The telemeter is in Safe Mode
- 2) The battery of the telemeter is discharged (and the telemeter has switched to Safe Mode)
- 3) The telemeter is too far away from the Configurator
- 4) The telemeter has been configured to the same channel as another telemeter

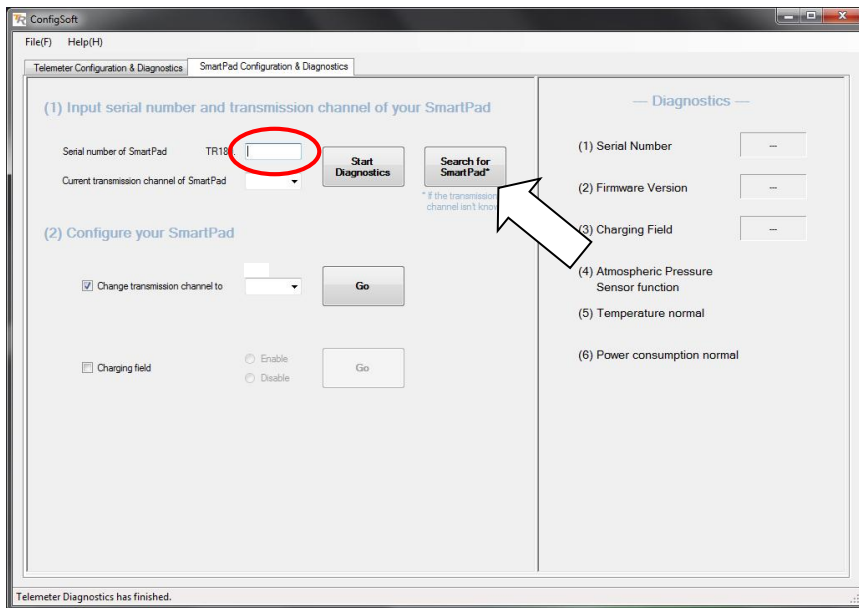
**Solutions**

- 1) Move the telemeter closer to the Configurator and run the search again.
- 2) Place the telemeter on a SmartPad in the region as shown on page 26 with an active charging field. Run the search again.
- 3) Try turning other telemeters to Safe Mode or move telemeter to another room (>5 m away) and run the search again.

Now that the telemeter has been found check the battery level (see Telemeter Diagnostics section). If the battery level is below 30% the telemeter needs to be charged before the Channel can be changed. Place the telemeter on a SmartPad with the same Channel and leave it to fully charge (90-100%).

*What if I do not know the Channel setting of a SmartPad?*

Go to the *SmartPad Configuration & Diagnostics* dialog. Enter the serial number of the SmartPad, make sure the SmartPad is turned on and press the “Search for SmartPad” button. The serial number of the SmartPad can be found on the front and back of the SmartPad.



# Calibration values

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## Pressure calibration

### Telemeter Pressure Recordings in the Animal

Telemeters are shipped sterile and dry, when implanted pressure values recorded in the first 48 hours after surgery may have an offset of up to 20 mmHg.

Before making any recordings from the implanted telemeter it is important that the telemeter has been turned on for a minimum of FOUR (4) hours.

### Calibration & Offset Testing

During factory calibration, we attempt to ensure the environment is as similar as possible to what the telemeter will experience when implanted in an animal. Users who wish to follow or check the offset either pre or post implantation need to precisely set the environment for the offset test as detailed below. **Please Note:** Telemeters should remain immersed throughout the testing procedure.

Key factors that need to be controlled are;

1. **Hydration;** Telemeters should be soaked for a minimum of 48 hours prior to offset check. It is important to ensure that, when checking the offset, the sensor tip is no more than 5 mm under the water so as to avoid a head of pressure effect.
2. **Switch on time;** On the bench, all telemeters have a signal settling period when first switched on. In order to correctly account for this “switch-on effect”, telemeters should be in active mode on a SmartPad for a minimum of FOUR (4) hours prior to checking the offset pressure.
3. **Telemeter Temperature;** Telemeters should be held at 38°C for a minimum of 30 min prior to recording values.
4. **Light;** Telemeters need to be in the dark.

If testing at the time of explant this process can be simplified:

1. The telemeter can be removed from the animal whilst still in active mode, put immediately in a Tergazyme solution and placed on the SmartPad.
2. Once cleaned, it can be placed in warm water at 38°C for 30 minutes in the dark. The output voltage obtained from the SmartPad at this zero pressure level should be close to 1.0 V.

Telemeters are all factory calibrated using the tightly controlled conditions as listed above. Under these conditions the voltage analog output from the SmartPad corresponds to the following pressures:

1V = 0 mmHg  
2V = 100 mmHg

## Biopotential calibration

Prior to shipping, all telemeters are calibrated so that the voltage analog output from the SmartPad corresponds to the following voltages:

0V = -2 mV  
2V = 0 mV  
4V = 2 mV

## Oxygen calibration

Prior to shipping, all telemeters are calibrated so that the voltage analog output from the SmartPad corresponds to the following voltages:

$$1V = 0 \text{ nA}$$

$$2V = -200 \text{ nA}$$

Calibrations coefficients will also be supplied with the electrodes which will need to be used in calculating the correct oxygen concentration.

## SNA calibration

Prior to shipping, all telemeters are calibrated so that the voltage analog output from the SmartPad corresponds to the following voltages:

$$0V = -60 \text{ } \mu\text{V}$$

$$2V = 0 \text{ } \mu\text{V}$$

$$4V = 60 \text{ } \mu\text{V}$$

\*\*SmartPad outputs are low pass filtered at 1 kHz. Additional filtering, rectification and signal integration can be performed using a data acquisition system.

## Temperature calibration

Prior to shipping, all telemeters are calibrated so that the voltage analog output from the receiver corresponds to the following temperatures:

$$0V = 0^{\circ}\text{C}$$

$$1V = 20^{\circ}\text{C}$$

# Telemeter general use

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Before implanting a telemeter make sure to write down the serial number and Channel setting.

## Channel Number

All telemeters are factory set to Channel “Setup” and need to be activated and configured to different channels before use. The Channel is set using the Configurator System (page 18).

**Telemeter Label (example)**



The telemeter model is TRM54P, the Serial number is 4168. The serial number is also on the outside label of the telemeter packaging.

## Telemeter recharging

Telemeters are designed to be recharged either before implantation or inside the animal. It is recommended to implant the telemeter fully charged (a value 90-100% when the telemeter is off the SmartPad).

To efficiently charge the telemeter before implantation place the telemeter on the SmartPad in one of the two areas shaded on the picture below. Make sure the SmartPad and telemeter are paired (i.e. set to the same channel). Full charging may take up to 5 hours. For the best estimate of the battery charge remove the telemeter from the SmartPad and use the diagnostics section of ConfigSoft to determine the battery level. For maximum battery capacity, we recommend charging the telemeter for a further hour after the battery level reaches 90-100%.



**For effective recharging within the animal, the telemeter body must lie parallel with the SmartPad when the animal is mobile. The telemeter body needs to be implanted within the abdominal cavity and attached to the abdominal muscle wall using the suture tabs. Charging will not be effective if the telemeter is placed on the side or on the back of the animal.**



# Telemeter Modes

Each telemeter has two modes: **Safe Mode - deactivated, not sending data**  
**Active Mode - sending data**

## Safe Mode

All telemeters are shipped in Safe Mode. This mode is used when the telemeter is being stored and has an extremely low current drain

To place a telemeter into **Safe Mode**:

- The telemeter needs to be at least 1m away from any active SmartPad.
- Use the Configurator System to place the telemeter into **Safe Mode**.
- Take care not to allow the telemeter to come within 1m of any active SmartPad or the telemeter will be activated by the field and will enter **Active Mode**. This will happen regardless of which Channel the SmartPad is configured to.

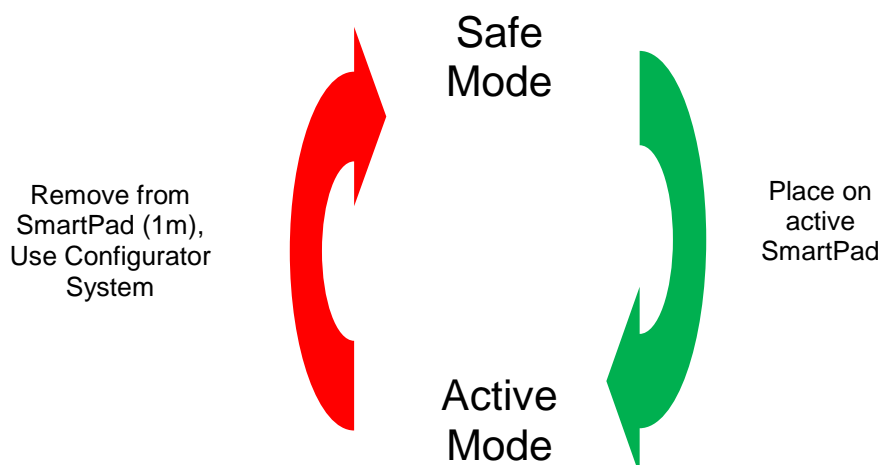
***Long Term Storage:*** Always fully charge your telemeter before storing. We recommend that the battery level of Small animal telemeters be checked regularly while in storage. At minimum the telemeter should be checked if it has not been used for 6 months. To do this, activate the telemeter by placing it on a SmartPad and run telemeter diagnostics in ConfigSoft. If the battery is not fully charged (90-100%) the telemeter should be re-charged. Don't forget to put your telemeter back into Safe Mode before storing.

## Active Mode

The telemeter must be in **Active Mode** to transmit data.

To change the telemeter to **Active Mode** from **Safe Mode**:

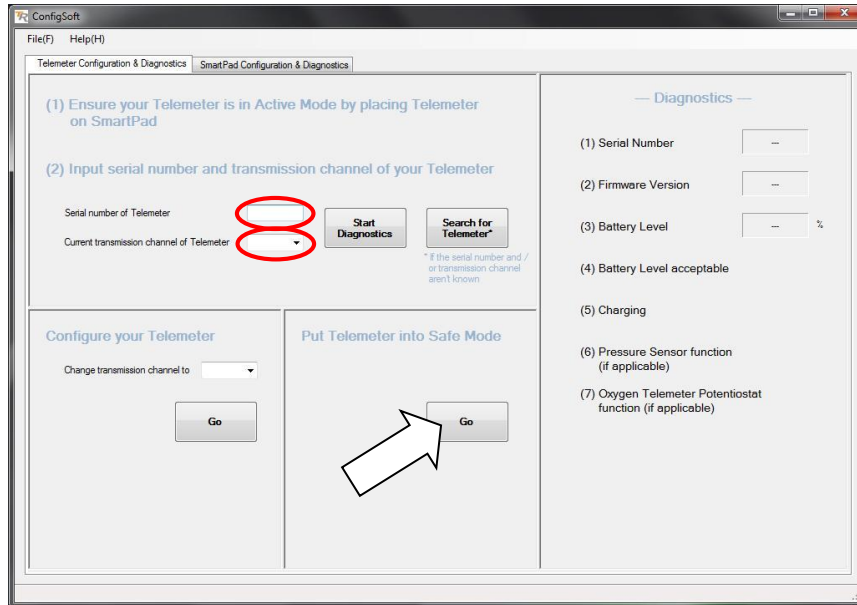
- Place the telemeter, in its sterile packaging, on the SmartPad and plug the power cable into the SmartPad. This will automatically switch the telemeter into **Active Mode**. Be aware that the telemeter is now sending data and using battery life.
- If the SmartPad is configured to the same transmission channel as the telemeter, the Status light on the front of the SmartPad will be green.



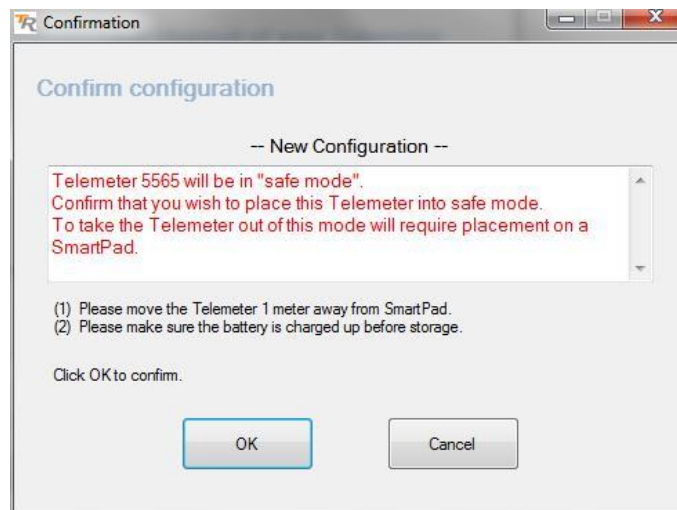
**If monitoring is not taking place for a period longer than 7 days it is recommended that the Telemeters be fully charged and placed in Safe Mode to protect battery life (damage to the telemeter can occur if left in a fully discharged state).**

# Placing a Telemeter into Safe Mode

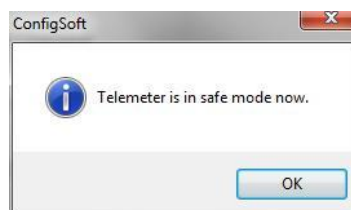
- 1) Connect Configurator to the computer with ConfigSoft loaded.
- 2) Start ConfigSoft.
- 3) Make sure the telemeter is not within 1m of an active SmartPad.
- 4) Enter telemeter Serial and Channel numbers.
- 5) Under “Put Telemeter into Safe Mode” Press Go.



- 6) Click OK to confirm.



- 7) The telemeter is now in Safe Mode. Make sure the telemeter does not come within 1m of any active SmartPad or the telemeter may become Active again.



## Positioning the Telemeter during surgery

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### Charging and Signal Maximization

For best charging performance, the telemeter must be implanted within the abdominal cavity and parallel with the SmartPad. Securing the telemeter to the abdominal wall using the suture tabs places it in the best position for recharging and signal communication. Never secure the telemeter by suturing around the pressure catheter or electrode leads. The pressure catheter can be inserted into the abdominal aorta for arterial pressure measurement and/or electrodes can be tunneled subcutaneously to the recording site. More information and surgical videos are available online at <http://millar.com/knowledge-center>



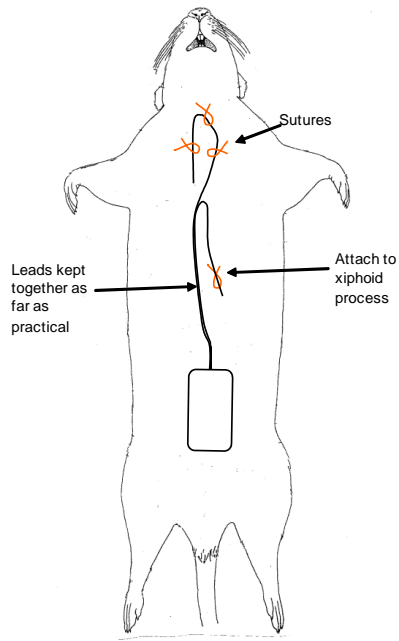
### Use of the Suture Tabs

Telemeters are shipped with two suture tabs attached. The suture tabs must be used to secure the telemeter in the correct position within the abdominal cavity. Care should be taken not to pierce or cut the suture tabs during either implantation or explantation of the telemeter. Should you damage either of the suture tabs then a pouch made of surgical mesh can be used to secure the telemeter in place (see page 30 for instructions).

### Biopotential lead separation

Depending on the model, telemeters may be supplied with bipolar electrodes that are suited to ECG data collection. The bipolar electrodes are supplied connected down their entire length. While separation of the ends is required to allow appropriate placement, we recommend that the electrode leads be kept together and run alongside one another for as far as practical. This will reduce electrical noise in recorded biopotential signals. A free length of no more than 3-4 cm is recommended for each electrode. It is not recommended that sutures be placed around the leads other than at the point of contact with the tissue as this may provide a stress point on the leads and cause them to break.

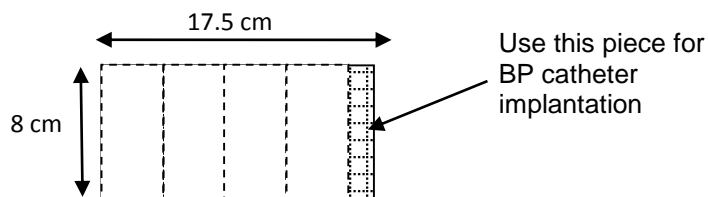
**Example  
placement of  
electrode leads  
for recording of  
high quality ECG**



# Construction of Mesh Pouches

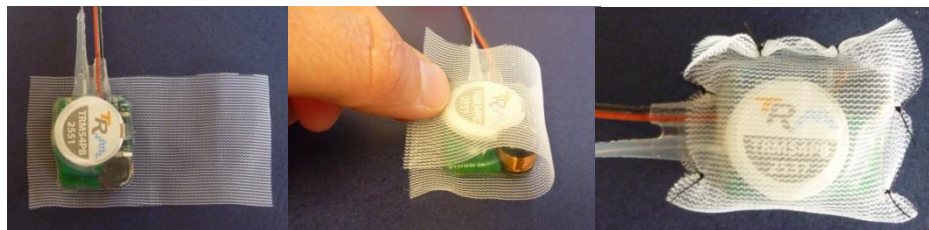
The suture tabs should be used to secure the telemeter within the abdomen and to the abdominal wall. However, should either suture tab be damaged, a mesh pouch can be fitted to the telemeter. Sutures through the mesh pouch can then be used during surgery to attach the telemeter to the abdominal muscle layer. It is important that the telemeter is not secured in place by suturing around either the catheter or electrode wires as this may lead to wire breakages.

The pouch should be made from surgical mesh or similar biocompatible material. Silk or similar suture material should be used to hold the mesh in place rather than sewing cotton. Suitable mesh is supplied as part of the BP Consumable Pack from Millar. The piece of mesh supplied can be used to make 4 small animal pouches. The excess mesh is used for securing the blood pressure catheter to the vessel.



## Construction

- 1) Cut a rectangle of mesh: 4 x 8 cm
- 2) Fold the mesh over the telemeter body and secure using sutures at a few points around the telemeter as pictured below.



Care must be taken not to pierce the silicone telemeter body with the needle or to cut or damage the catheter or electrodes.

## Sterilization\*/Surgery

*Mesh not fitted to telemeter (construct pouch at the time of surgery)*

- Autoclave mesh with surgical pack
- Ethylene Oxide (gas sterilization)
- Alcohol/Chemical – mesh must be rinsed thoroughly in sterile saline before construction and implantation

*Mesh fitted to telemeter before sterilization*

- DO NOT AUTOCLAVE
- Ethylene Oxide (gas sterilization)
- Chemical Sterilization (NOT ethanol) – Telemeter and mesh must be rinsed thoroughly with sterile saline

\* See Sterilization section for more details of recommended sterilization procedures.

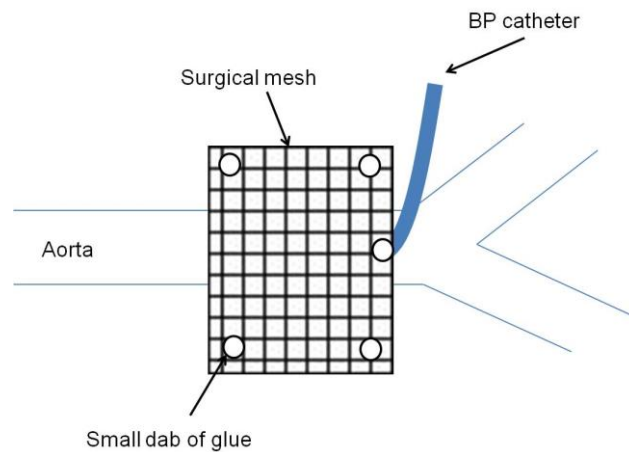
## Removal

At the end of the experiment, great care must be taken when removing the telemeter from the animal. Tissue will grow into the mesh so it may be difficult to see the telemeter body. **Never use a scalpel** to cut away the mesh. Scissors should be carefully used taking great care not to cut the telemeter body, catheter or electrodes. The mesh pouch should be discarded and a new one fitted for the next use.

# Surgical Mesh for BP Catheter Implantation

Tissue adhesive can detach from tissue after a period of time allowing the BP catheter to pull out of the vessel. To avoid this, we recommend the use of a piece of surgical mesh at the time of implantation. Scar tissue will grow into the mesh fabric holding the catheter in place and reducing reliance on the glue itself.

1. Insert catheter into the vessel and use the smallest amount of glue to hold the catheter in place and to stop any blood leakage (see surgical videos online at <http://millar.com/knowledge-center>)
2. Dry the surrounding area using swab sticks
3. Cut a small square of surgical mesh (5 x 5 mm).
4. Place the mesh over the aorta and catheter so that the slit sits around the catheter.
5. Glue the mesh to the catheter and use small amounts of glue to attach the mesh to the surrounding tissue. Take care not to put too much glue on the vessel or blood flow may be restricted when it dries.



# Telemeter Care and Handling

## Warnings

The telemeter pressure catheter (if fitted) is shipped with foam over the catheter tip to protect the sensor area. The catheter tip should be kept in the foam and should always be stored in the plastic tray and box provided between uses.

## Precautions: Telemeters with Pressure Sensors

Proper handling of the telemeter and pressure catheter is very important to avoid damage and extend the telemeter life. **Take care not to damage the telemeter body, pressure catheter or electrode as they are non-repairable.** It is highly recommended that users view the online videos on handling the telemeters during implantation, explantation and cleaning. <http://millar.com/knowledge-center>

*\*\*If handling the pressure catheter using forceps, the forcep tips should always be padded using soft tubing (e.g. silicon). This will protect the wires inside the catheter from being crushed.*

## Use and Handling

- Inspect the catheter (using a microscope) for damage (cracking, kinks, etc.) before each use.
- Clean the telemeter and sensor and electrodes immediately after each use (see Cleaning Instructions).
- Do not touch the pressure sensor area with sharp objects. Do not make sharp bends in the catheter.
- Do not apply direct pressure to the pressure sensor area with instruments such as forceps or tweezers.
- When handling the catheter with either fingertips or surgical instruments, always handle the catheter 5-10 mm proximal to the sensor area. The sensor area contains very fine wires which may be damaged or broken if the catheter is gripped too close to the sensor or too tightly, be GENTLE.
- Always know the location of the catheter tip.
- Do not place heavy objects or metal instruments on top of the catheter or telemeter.
- Take care not to cut the catheter during surgery or when removing the telemeter from the animal.

	DO:	DO NOT:
Pressure Sensor	Clean immediately after use	Do NOT clean with stiff-bristled brush Do NOT clean with high pressure water jet
	Protect sensor tip when not in use	Do NOT tap the sensor against a hard surface
		Do NOT apply excessive force to the sensor tip Do NOT expose to excessive pressure
Catheter Body	Clean immediately after use	Do NOT cut, crease, knot, fold, kink, or crush with forceps or clamps of any kind
After removal from animal	Keep catheter and sensor wet until cleaned	Do NOT expose to alcohol, cresols, phenols, mercury compounds, hypochlorites, acetone, peroxide, silicone chlorine, xylenes, trichloroethylene, or freon
	Clean thoroughly with approved enzymatic cleanser immediately	Do NOT use ultrasonic cleaner
Disinfection or Sterilization	Dry catheter before sterilizing with ethylene oxide	Do NOT autoclave, irradiate (gamma/ebeam), plasma, peroxide or formaldehyde vapor solutions
	Use a recommended cleaning agent	Do NOT use Sporox or Cidex PA solutions



## Telemeter Removal and Preparation for Reuse

If the user takes care, the telemeters are designed to be reused. After implantation for a long period of time it is common to find the catheter, electrodes and telemeter body covered in connective tissue. When removing the telemeter take care to avoid damaging catheter, electrodes or telemeter body (including suture tabs). Never use a scalpel to cut tissue from around or above the telemeter as it could damage the telemeter. When detaching the telemeter body from the muscle, take great care to only cut the sutures holding it in place and not the suture tabs themselves. It may be necessary to first clear attached tissue from the area so that the suture thread can be visualized. Extreme care should also be taken not to damage the pressure catheter and sensor tip during telemeter removal.

The telemeter should be soaked in cleaning detergent (see below). After soaking and using a microscope the sensing tip should be **gently** wiped with a soft cotton gauze pad or swab sticks to remove any remaining film or deposits. Care must be taken not to damage the sensing tip, do not pick up the catheter by the sensor tip or have any sharp objects near this tip.

### Cleaning

1. After removing the telemeter from the animal, immediately soak it in a beaker or dish filled with fresh saline or distilled water. Keep soaking until you are ready to continue cleaning; DO NOT allow it to dry.
2. Soak in a recommended enzymatic cleaning solution (listed below). This is essential to prevent protein build-up on the pressure sensor. Without the use of an enzymatic cleaner, a protein film will form that can result in pressure signal drift.

Type	Trade Name	Manufacturer	Active Ingredient	Soak Time/Temp
Enzymatic Detergent	Enzol® (in UK: Cidezime®)	Advanced Sterilization Products (J&J)	Propylene Glycol	15 mins / room temperature
	Endozine®	Ruhoff Corporation	Propylene Glycol	15 mins / room temperature
	Terg-A-Zyme®	Alconox	Sodium Dodecylbenzene	15 mins / room temperature

3. After soaking (recommended times), gently wipe the sensing tip under a microscope with a soft cotton gauze pad or swab sticks to remove any remaining film or deposits. Care must be taken not to damage the sensing tip.
4. After soaking and wiping, thoroughly rinse the telemeter with fresh distilled water or saline.
5. After rinsing is complete, gently dry the catheter as follows:
  - Fold a soft tissue or kim wipe
  - Use gentle stroking to dry the catheter tip.
  - **Do not** pull the catheter tip through a folded tissue.
  - **Do not** allow the catheter to air dry on a tray, table, or countertop.
6. After the cleaning and drying procedure is finished:
  - Protect the sensor area on the catheter tip by carefully placing it in the foam that came with the telemeter.
  - Return the telemeter to its original plastic the tray.
  - Slide the tray inside the box and now store the telemeter in a cool, dry place until the next use.

**CAUTION:** Delays in rinsing a telemeter after removal will reduce cleaning effectiveness! Examine the pressure sensor active surface (diaphragm) for blood or materials not removed by cleaning. A dirty sensor may cause baseline drift when used the next time.

### Cleaning Agents



An enzymatic detergent can help in removing biological tissue from the catheter and telemeter body (e.g. Terg-A-Zyme®). These are generally available from most hospital supply companies and are generally labeled for use on fabrics or surgical equipment/instruments. The purpose of the detergent is to remove blood, serum proteins, and tissue debris from the surface of the telemeter. It is important that any product that has a surfactant CANNOT be used with any pressure telemeters.

We recommend Terg-A-Zyme is an enzyme-active powdered detergent made by Alconox, Inc. To make a 1% solution, mix 10 grams of powder with 1 Liter of cold or warm water. Allow the telemeter to soak for a minimum of 15 minutes and a maximum of 24 hours in the solution. Rinse thoroughly, preferably with running water. Fisher Scientific is a company that supplies Terg-A-Zyme (catalog #50-821-785, [www.fishersci.com](http://www.fishersci.com)) but please refer to the Alconox website for other companies ([www.alconox.com](http://www.alconox.com)). Terg-A-Zyme is not a sterilant. Telemeters must be sterilized before re-implantation. Please see following section for more information.

**Note: If checking the offset/calibration of the telemeter, the conditions listed under Calibrations Values must be replicated, i.e. clean, hydrated, turned on for 4 hours, at 38°C and in the dark.**

## Sterilization

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Preventing infection is very important in collecting quality recordings of normal physiology and animal survival. It is important to make sure the implanted telemeter is sterile before implantation.

**Under no circumstances should the telemeter be autoclaved or subjected to temperatures over 60°C as this will damage the telemeter.**

**Do not use alcohol as a sterilizing agent. This will damage the telemeter.**

**Do not sterilize by radiation (gamma or e-beam), plasma, peroxide or formaldehyde vapor solutions.**

**Tissue Oxygen telemeters: The electrodes in particular the carbon paste electrode should not be sterilized. Please see <http://millar.com/knowledge-center> for access to online recommendations.**

### Disinfection/Sterilization

1. The telemeter must be cleaned, rinsed and dried before disinfection or sterilization. Soil, debris, proteins, and water can interfere with the effectiveness of the following procedure. **Note** that some disinfectants have a limited usable life after activation or opening the container, failure to take notice of the warnings can prevent the effectiveness of the disinfection process.
2. Prepare the disinfectant according to the manufacturer's instructions.
3. Soak the telemeter in the disinfectant at the temperature and time intervals listed.
4. Rinse the telemeter well in sterile pyrogen-free water (or sterile saline) before implantation. A minimum of three separate rinses is recommended. Do not reuse any of the water used for rinsing since it will be contaminated with the disinfectant.

**CAUTION: Use only the listed recommended cleaners and disinfectants for the times/temperatures indicated.**

## Chemical Sterilants

Available from most hospital supply companies, chemical sterilants are considered cold sterilants and should be used for the sterilization of heat sensitive medical equipment such as Millar telemeters. When used properly, chemical sterilants will destroy all viable forms of microbial life.

Glutaraldehyde may be used to sterilize the telemeters. Glutaraldehyde (Fisher Scientific) must be diluted to 2% before use. Check your local chemical supply company for availability. Do not use gluteraldehyde solutions containing surfactants (i.e. Cidex 7, Cidex Plus 28 Day & Metrocide 28).

## Rinse with Sterile Saline

The telemeter should always be washed in sterile saline before implantation to remove all traces of the sterilant. Use it to temporarily store (< 48 hours) the telemeter aseptically until surgical implantation.

## Ethylene Oxide Gas Sterilization

These sterilizers operate at a low temperature of 55°C and use chemicals as the sterilant. Items are packed and dry at the end of the sterilizing cycle. Telemeters are suitable for Ethylene Oxide sterilization as long as they are not subjected to temperatures above 60°C.

Customers are liable for product replacement if recommended products and instructions are not used or followed. If there are any questions about a chemical or procedure please contact Millar (support@millar.com).

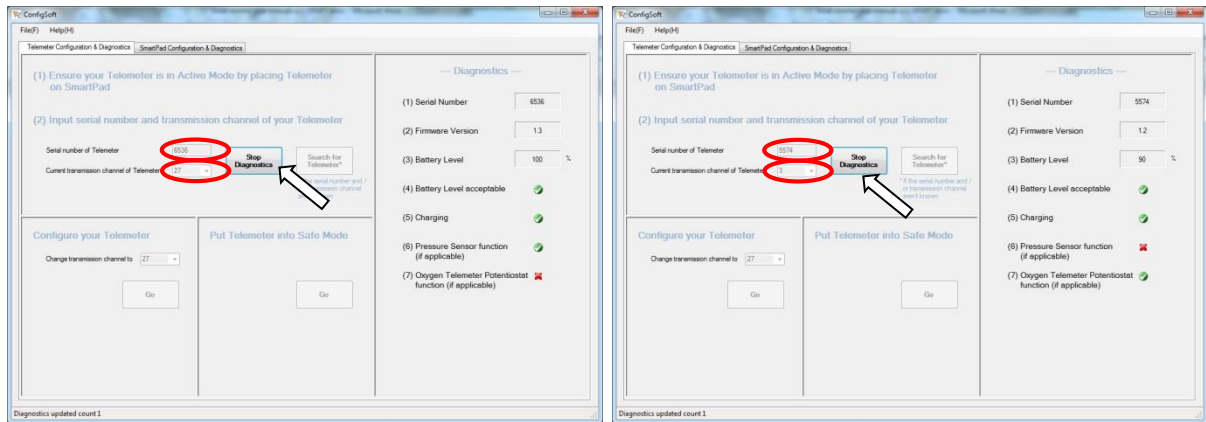
**Warning: Some examples of chemicals that will cause damage to telemeters include, but are not limited to: alcohols, phenols, iodophors, and hypochlorite. Please confirm with Millar before using any product other than the approved products list below.**

Type	Trade Name	Manufacturer	Active Ingredient	Soak Time / Temperature
High-level disinfectant	Cidex Activated Dialdehyde Solution	Advanced Sterilization Products (J&J)	Gluteraldehyde	1-2 hours / 25°C (77°F)
	Cidex® OPA	Advanced Sterilization Products (J&J)	Orthophthalaldehyde	16-30 mins / 20°C (68°F)
	MetriCide®	Metrex	Gluteraldehyde	1-2 hours / 25°C (77°F)

\*\* Products with similar names are available but may not be suitable. Please use only products specified or contact Millar for clarification (support@millar.com).

# Telemeter Diagnostics

Using the Configurator System the user can investigate the status of the telemeter. To run diagnostics enter the serial and channel numbers of the telemeter and click “Start diagnostics” on the *Telemeter Configuration & Diagnostics* dialog. In diagnostic mode the telemeter will continue to transmit data.



Pressure telemeter

Oxygen telemeter

After clicking on the Start Diagnostics you will be asked if you wish to save a log file. This can be useful to monitor the telemeter over a period of time or if you are asked to send information to support staff at Millar. The log file and display are both updated every 10 s. A count of the updates is shown in the bottom left hand corner of the window. If you choose to save a log file you will not be able to stop the diagnostics for at least 5 minutes. ConfigSoft will ask you to confirm the name and location for the log file. The default filename includes the telemeter serial number and the date and time the diagnostics was started e.g. Tx5574\_log\_2013\_5\_9\_16\_11.txt

PLEASE NOTE: Depending on the telemeter you have the **✗** may appear if the telemeter does not have that function i.e. oxygen telemeters will have a **✗** for the pressure sensor.

## **Battery Level**

✓ = the battery is more than 20% charged.

✗ = the battery is low and the telemeter needs to be recharged. If the telemeter is not placed on an active SmartPad it will automatically enter Safe Mode.

**Note: The battery level reported during diagnostics may be artificially high while the telemeter is charging. For an accurate battery level, remove the telemeter from the SmartPad for 1 minute before noting the battery level.**

## **Charging**

✓ = the telemeter detects a charging field from a SmartPad and charging is occurring.

✗ = the telemeter cannot detect a charging field from a SmartPad and is not charging. A telemeter will continue to run off its battery for approximately 4 hours (if fully charged).

Troubleshooting Charging: there are a number of possible situations for a **✗** next to Charging:

- 1) The Charging field of the SmartPad has been disabled using Configurator System.
- 2) The telemeter is not within 5 cm of the charging surface of a SmartPad.
- 3) The SmartPad has temporarily turned the scheduled charging field off for a temperature update.
- 4) The telemeter is in an area of the SmartPad with low field strength or it may not be parallel to the SmartPad surface therefore in the wrong orientation to receive charging from the field efficiently.

### Pressure sensor function

This only applies to telemeters with a pressure sensors e.g. TRM54P, TRM54PB, etc

✓ = the pressure sensor is functioning normally.

✗ = a problem has been detected with the pressure sensor (contact your distributor or support@millar.com)

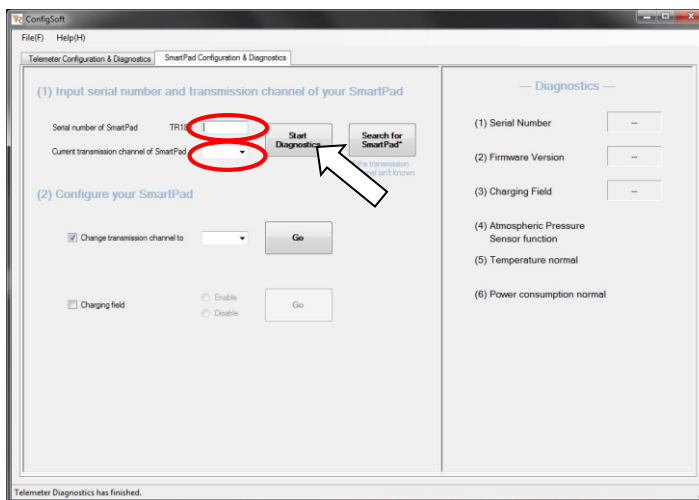
### Oxygen Telemeter Potentiostat

✓ = the oxygen sensor is functioning normally.

✗ = a problem has been detected with the oxygen sensor.

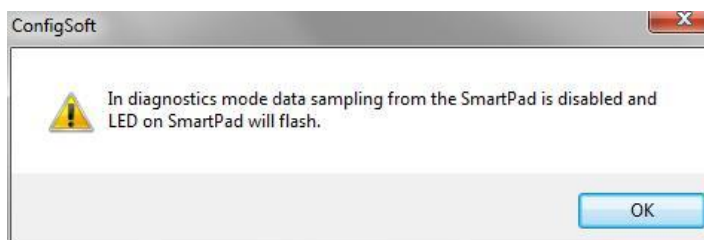
Please contact Millar for further assistance (support@millar.com).

## SmartPad Diagnostics

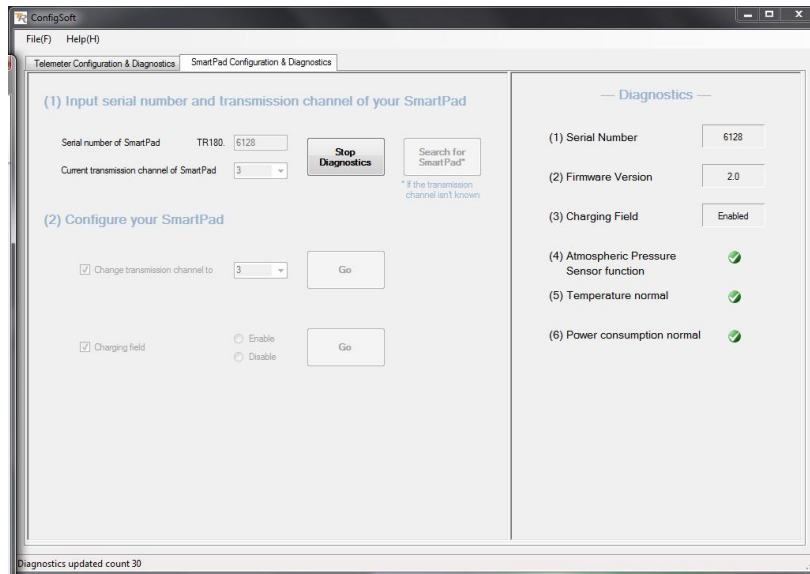


Using the Configurator System the user can investigate the status of their SmartPad. To run diagnostics enter the serial and channel numbers of your SmartPad and press the “Start diagnostics” button on the *SmartPad Configuration & Diagnostics* dialog. Please note that you cannot record data from your telemeter using a SmartPad that is in Diagnostics mode instead a saw tooth pattern is output from the SmartPad analog outputs.

Press OK to continue. You will be asked if you wish to save a log file. This can be useful to monitor the SmartPad over a period of time or if you are asked to send information to support staff at Millar. The log file and display are both updated every 10 s. A count of the updates is shown in the bottom left hand corner of the window. If you choose to save a log file you will not be able to stop the diagnostics for at least 5 minutes. ConfigSoft will ask you to confirm the name and location for the log file. The default filename includes the SmartPad serial number and the date and time the diagnostics was started e.g. Sp6096\_log\_2013\_5\_9\_16\_48.txt



The SmartPad will now be in Diagnostics mode and the Status light on the front will flash orange.



### **Atmospheric Pressure Sensor function**

✓ = the atmospheric pressure sensor is functioning normally.

✗ = a problem has been detected with the atmospheric pressure sensor. This can be caused by a brief loss of communication with the SmartPad. If it occurs frequently or continues for more than 30s please contact Millar (support@millar.com).

### **Temperature normal**

✓ = the temperature of the SmartPad is at acceptable levels.

✗ = the temperature is above acceptable limits. Please contact Millar (support@millar.com).

### **Power consumption normal**

✓ = SmartPad power consumption is normal.

✗ = Excess power consumption has been detected. The Status light on the front of SmartPad will be red. This cause may be that the SmartPad is too close to a metal surface or another SmartPad. The SmartPad will continue receiving and outputting data but the charging field will have been turned off. To correct the situation, unplug the SmartPad and try moving the SmartPad away from any metal surfaces and other SmartPads re-plug in the power cable to reset the SmartPad. If the problem continues please contact Millar (support@millar.com).

# SmartPad Technical Specifications

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SmartPad	Contains ambient pressure monitor, outputs standard analog voltage compatible with any data acquisition system (BNC), recharges the telemeter battery.
Weight	2.5 kg
Dimensions	400(w) x 450(d) x 60(h) mm
Cage platform dimensions	295(w) x 425(d) mm
Power input	100-240 V, 50-60 Hz
Max Power draw	40W
Temperature Operating Range	10 to 40 degrees Celsius
Output Connectors	BNC x 3
Output Voltage Range	0 to 4V
Low Pass filtering on signal outputs	Cut off frequency = 1000 Hz

# Telemeter Technical Specifications

The technical specifications in the table below are for the TRM5\* series telemeters. Some specifications may not be relevant depending on the model of the telemeter.

Pressure sensor accuracy	±2 mmHg
Pressure sensor drift	<4 mmHg per month
Pressure sensor Frequency response	DC to 500 Hz (-3 dB)
Standard pressure catheter dimensions	Distal tip; 660 µm OD (2Fr), Catheter; 500 µm (1.5Fr), length 9 cm
Pressure sensor range	-20-300 mmHg
Ambient pressure range	650 to 800 mmHg
Maximum operating altitude	1300 m
Biopotential Input range	±2 mV
Biopotential Resolution	12 bit A/D
Biopotential High pass characteristics	AC coupled, single pole, -3dB point at 0.7 Hz
Biopotential Electrode leads	Coiled stainless steel
Biopotential Electrode diameter	1 mm
SNA Input range	±60 µV
SNA High pass filter	-3dB point at 1.5 Hz
SNA Input impedance	500 kOhms at 1000 Hz
SNA Electrode leads	Multi-stranded stainless steel (length 25cm)
SNA Electrode diameter	0.15 mm (wire only)
Temperature operating range	8 to 41 degrees Celsius
Sampling frequency	2000 Hz
Low Pass filtering by SmartPad	Cut off frequency = 1000 Hz
Transmission range	Up to 5 m (range may vary depending on laboratory configuration)
Transmitted signal	Fully digital at 2.4 GHz
Channels	30 transmission frequencies are available, user set
Minimum animal weight	200 gm
Outer material	Silicone
Weight	Approximately 12.5 gms
Dimensions	31.5 x 24 x 11 mm
Battery life	Continuous on SmartPad. If the animal is away from the SmartPad charging field (or the SmartPad charging field is turned off) battery life is ~4-6 hrs.
Recharge time	Minimum 3 hours
On-off mechanism	Activation via the SmartPad and deactivation via Configurator System.
Calibration	No user intervention required (calibration values stored within each telemeter).
Analog output calibration values	Pressure: 1V output = 0mmHg, 2V output = 100 mmHg Biopotential: 2V output = 0mV input, 4V output = 2 mV input SNA: 2V output = 0µV input, 4V output = 60 µV input Temperature: 0V output = 0°C, 1V output = 20°C



# Oxygen Telemeter Technical Specifications

The technical specifications in the table below are for the TR57Y Tissue Oxygen telemeter.

Potentiostat type	Voltage controlled current source
Set potential	-0.65V (-650mV)
Potentiostat current measurement range	0 to -600nA
Potentiostat resolution	12 bit A/D
Potentiostat electrode leads	Coiled stainless steel (~28 cm)
Potentiostat electrode lead diameter	1 mm
Temperature operating range	20 to 41 degrees Celsius
Sampling frequency	2000 Hz
Low Pass filtering in telemeter	Cut off frequency = 1000 Hz
Transmission range	Up to 5 m (range may vary depending on laboratory configuration)
Transmitted signal	Fully digital at 2.4 GHz
Channels	30 transmission frequencies are available, user set
Minimum animal weight	175 gm
Outer material	Silicone
Weight	Approximately 12.5 gms
Dimensions	31.5 x 24 x 11 mm
Battery life	Continuous on SmartPad. If the animal is away from the SmartPad charging field (or the SmartPad charging field is turned off) battery life is ~4-6 hrs.
Recharge time	Minimum 3 hours
On-off mechanism	Activation via the SmartPad and deactivation via Configurator System.
Calibration	User required to compensate for the individual Carbon Paste Electrode sensitivity coefficient supplied with each Blue Box electrode. Sensitivity range is 1-2nA/ $\mu$ Mol.
Analog output calibration values	Oxygen: 1V output = 0nA, 2V output = -200nA Temperature: 0V output = 0°C, 1V output = 20°C

# Frequently Asked Questions.....

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## Battery and recharging

### ***Would the animal be harmed by staying in the SmartPad charging field?***

There are no known biological effects of the inductive field. Studies have shown that a field strength much higher than the Millar SmartPad have no effect. The level of magnetic field is quite low and remains useable only ~5 cm above the SmartPad.

## Telemeter

### ***How many animals can be monitored at one time?***

Each telemeter sends its signal on one of 30 unique transmission channels. Therefore up to 30 telemeters can be used within a 5 m range of one another. If you need to have more animals in close proximity, contact Millar to discuss a customized solution.

### ***Is there any interference between telemeters?***

No. As long as each telemeter is set to use a different channel they use a separate transmission frequency. No shielding is required between cages. Close proximity is possible. The transmission frequency is in the 2.4 GHz band.

### ***What is the life expectancy of the telemeters?***

The telemeters are designed for the implantation in the abdomen. As this is a relatively hostile environment users should not expect the same life time as for bench top based laboratory items. However with appropriate care during implantation and explantation users should expect to reuse the telemeters.

## SmartPad questions

### ***Why does my SmartPad keep showing a red light and my telemeter goes flat?***

A red light on your SmartPad suggests that the SmartPad has automatically disabled the charging field due to detection of a high current. In this mode data output will continue but battery charging is not occurring. Cause: may be due to the SmartPad being placed too close to a metal surface or to another SmartPad. Move the SmartPad away from any metal and then reset by unplugging the power and plugging it back in (see page 13).

### ***I need to record from my animal while it is near metal. How can I do this?***

Use the Configurator System to disable the charging field of the SmartPad. Remember that the telemeter will run of battery power and therefore data can be collected for approximately 4 hours if fully charged.

## Further questions?

Millar Instruments is proud to offer unlimited technical support and advice to all its customers. Our team of engineers and physiologists can advise on specific applications and equipment configurations. Please contact us

# Contact Information

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