

KAHA
SCIENCES

MOUSE TELEMETRY

User Manual

Contact Information

Kaha Sciences is an ADInstruments NZ Limited brand

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For complete product instructions, general insights and surgical recommendations, visit adinstruments.com and access our free online support www.adinstruments.com/support/kaha .
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Contents

ADInstruments Disclaimer & Warranty for Kaha Sciences Products.....	3
Background	3
Responsibilities	3
Disclaimer	3
Warranty	3
Rat Telemeter Warranty	3
Mouse Telemeter Warranty	3
Telemetry Hardware Warranty	3
Defects	3
General Limitations	3
FCC Compliance	4
Telemeter (MT10B).....	4
TR190 Configurator	4
MT110 tBase	5
The Wireless Power Transfer System is FCC Part 18 Compliant	5
The 2.4GHz Data Transmitter is FCC Part 15 Compliant	5
Introduction	6
Telemetry System Key Features.....	6
High Accuracy	6
24/7 Uninterrupted Recording	6
High Versatility	6
Efficient Simple Housing	6
Global Service & Support	6
Telemetry Setup Overview	7
Telemetry Components	7
The Telemeter	7
The tBase	7
The Configurator System	8
Quick Start for Mouse Telemetry.....	9
The Telemeter.....	10
Overview	10
Telemeter Packaging and Channel.....	10
tBase.....	11
Overview	11
tBase Optimization.....	12
tBase Shelving Setup	12
tBase Status lights	12
Analog Outputs and Calibration Values	13
Configurator System.....	14
Configurator Software (ConfigSoft) Installation.....	14
Configurator Hardware Connections.....	16
Configurator Software - Overview	17
Mouse Telemeter	18
tBase	18
Setting Up the System.....	19
Pairing a tBase and Telemeter	19
Changing Telemeter Channel	20
Failed telemeter Communication with Configurator System	21
Changing tBase Channel.....	22
Failed tBase Communication with Configurator System	23
Diagnostics	24
Mouse Telemeter and tBase Diagnostics	24
tBase Temperature.....	24
tBase Power Consumption.....	24
Diagnostics Files.....	24
Usage and Maintenance	25
Positioning the Telemeter during Surgery.....	25
Ideal Powering and Signal Maximization.....	25
Biopotential Lead Placement.....	26
Telemeter Care and Handling.....	27
Chemical Sterilants	27
Ethylene Oxide Gas Sterilization.....	27

Technical Specifications	28
tBase Technical Specifications	28
Telemeter Technical Specifications	29
Frequently Asked Questions.....	30

To all users;

We pride ourselves on helping you achieve excellent results. If you have any questions related to the operation of your system, please contact us at adi.to/support.

ADInstruments Disclaimer & Warranty for Kaha Sciences Products

Background

Kaha Sciences is a brand owned and operated by ADInstruments NZ Limited. ("ADInstruments")

Responsibilities

The Purchaser and any others using any ADInstruments product or solution agree to use it in a reasonable manner for purposes for which it is suited, and agree to take responsibility for their actions and the results of their actions. If problems arise with an ADInstruments product, ADInstruments will make all reasonable efforts to rectify them. This service may incur a charge, depending on the nature of the problems, and is subject to the other conditions in this Disclaimer and Warranty.

Disclaimer

Except as specified below, ADInstruments makes no warranties, express or implied, and specifically disclaims any warranty of the products' fitness for a particular purpose. The Kaha Science Products supplied by ADInstruments are intended for use in teaching and research applications and environments. Products supplied by ADInstruments are NOT intended to be used as medical devices or in medical environments. That is, no product supplied by ADInstruments is intended to be used to diagnose, treat, or monitor a person. Furthermore no product is intended for the prevention, curing or alleviation of disease, injury or handicap.

Warranty

Rat Telemeter Warranty

ADInstruments comprehensive telemeter warranty guarantees that telemeters will be free from defects in materials and workmanship for sixty (60) days after the date of implantation **provided that** implantation occurs within six months of the date of shipment/purchase of the rat telemeter and that upon implantation the telemeter is registered at adi.to/telemeter-register.

In order to activate this warranty, registration of all rat telemeters is compulsory upon first implantation. Registration must occur within six (6) months from the date of shipment/purchase.

Mouse Telemeter Warranty

ADInstruments warrants that at the time of sale and shipment to the original purchaser, Kaha Sciences mouse telemeters shall be free from defects in material and workmanship for 90 days from the date of shipment.

Telemetry Hardware Warranty

ADInstruments 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) year from its date of shipment to the original purchaser. Should the hardware become damaged after expiration of the one-year warranty, ADInstruments will accept the product for evaluation with a signed RMA (return material authorization) and at a cost of USD100. If repairs are required, ADInstruments will provide a detailed quote and lead time, and will not commence the repair work until the customer has approved the quote. As part of ADInstruments continued commitment to customer support, free online, phone and email support in the use of all telemetry equipment is available beyond all warranty periods.

Defects

If there is a defect in a Kaha Sciences Product (other than telemeters which cannot be repaired), as Purchaser's sole remedy hereunder, ADInstruments will repair or replace the equipment as appropriate, and the duration of the warranty shall be extended by the length of time needed for repair or replacement. To obtain service under this warranty, the Purchaser must notify the nearest ADInstruments office, or Authorized Representative, of the defect before the warranty expires. The ADInstruments or Representative office will advise the Purchaser of the nearest service center address to which the Purchaser must ship the defective product at his or her own expense. The product should be packed safely, preferably in its original packaging. ADInstruments will pay return shipping costs.

General Limitations

ADInstruments products are produced to high standards, and should perform as described in the supplied documentation. There is a limited hardware warranty, and technical support is provided for all ADInstruments products. Nevertheless, since ADInstruments products could be affected by external factors (for instance, the computer system on which they run and other hardware and/or software provided by third parties), absolute performance and reliability of products and the overall solution cannot be guaranteed. No warranty, either expressed or implied or statutory, other than that expressly contained in this Warranty and Disclaimer, is made in respect to ADInstruments products or software, third party products or software, the overall solution or otherwise. The Purchaser therefore assumes all risks as to the performance and reliability of the products, the software, the solution and the results gained using them. ADInstruments neither assumes nor authorizes any person to assume on its behalf any liability in connection with the sale, installation, service or use of its products. ADInstruments shall not be held responsible for special, consequential or punitive damages of any kind arising out of sale, installation service or use of its products.

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FCC Compliance

Telemeter (MT10B)

The devices comply 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 ADInstruments 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 ADInstruments could void the user's authority to operate the equipment.

MT110 tBase

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 ADInstruments could void the user's authority to operate the equipment.

Introduction

This User Manual contains information to help in the correct installation and basic use of the Kaha rat telemetry system. It is **strongly recommended that you visit our online Knowledge Centre**, www.adinstruments.com/support/kaha for more detailed information and to view instructional videos showing telemeter implantation and recommendations for cleaning and care for your whole system.

The Kaha mouse telemetry system uses a unique and efficient patented inductive power transfer system for making long-term recordings in conscious mice (>22 g). No battery is required to wirelessly record high quality biological signals 24/7. Forty independent transmission frequencies (Channels) mean that up to 40 telemetered mice can be housed in a single room without the need for shielding. Each mouse telemeter only communicates with the receiver contained in the tBase set to the same communication Channel, eliminating crosstalk. The system comprises of a telemeter, tBase and Configurator System. The mouse biopotential telemeter measures electrical potential (ECG, EMG, EEG) between the positive and negative leads and transmits the data wirelessly to the tBase. The tBase provides wireless power to the telemeter and is also the receiver for the digital data (sampled at 2 kHz) transmitted by the telemeter, converting it to an analog signal. The tBase has BNC analog outputs which are compatible with all acquisition systems with analog inputs. The Configurator System allocates telemeter and tBase data transmission frequencies and provides diagnostic information on the telemeter or tBase.

Due to continual product improvement, your system may look slightly different to the images and graphics contained in this manual. If you have any questions, please contact us at adi.to/support.

Telemetry System Key Features

High Accuracy

Provides long term digital wireless recording of physiological data with high frequency sampling (sampling at 2 kHz), resulting in high data quality and signal integrity.

24/7 Uninterrupted Recording

Data can be collected 24 hours a day while the animal is on the tBase.

High Versatility

Telemeters send data wirelessly from within the animal to the tBase, which is then converted to analog signals that can be recorded by any PowerLab and LabChart data acquisition system. LanChart software provides a great range of recording and analysis options.

Efficient Simple Housing

Animal cages can be next to each other in one location for simultaneous data collection from multiple animals. No specialized cages or shielding are required as each telemeter operates digitally using one of 40 independent frequencies with no interference to recordings.

Global Service & Support

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

Telemetry Setup Overview



A mouse telemetry setup consists of three main components, which are the mouse telemeter, the tBase and the Configurator System. Therefore, a typical telemetry setup for each animal will require one telemeter of your choice and one tBase. The measured data by a telemeter is collected by its corresponding tBase that is set to the same Channel (communication frequency) as the telemeter. Data collected by the tBase is then recorded by a PowerLab and LabChart data acquisition system via BNC-BNC cables. Each laboratory setup will just require one Configurator in order to configure all your telemetry equipment.

Telemetry Components

The Telemeter

The telemeter is a fully implantable precision electronic device that is designed to measure specific physiological signals within an animal. Its electronics is safely contained within a biocompatible ceramic case, while its extending leads can be placed at suitable measurement sites of interest within the animal. All telemeters are individually packaged, shipped on the same Channel "Setup". Therefore, each telemeter will need to be configured to the same Channel (frequency) to its designated tBase prior to implantation.



Please note: When handling the telemeter, care must be taken not to damage the telemeter body, catheter or lead wires, because the telemeters are non-repairable. You can read the Telemeter Care and Handling section for more information (page 27).

The tBase

The tBase acts both as a universal inductive telemeter powering platform and a data receiving station for any paired Kaha mouse telemeter. Each tBase is supplied with three 4m BNC-BNC cables to connect to a PowerLab and LabChart data acquisition system.



Please note: For the safe and normal operation of the tBase it needs to be placed on a flat non-metallic surface. There must not be any metal or another tBase within 10-15 cm of any tBase and we recommend at least a minimum of 40 cm separating distance above or below another tBase (page 12).

The Configurator System

The Configurator System includes both the Configurator (TR190) hardware and ConfigSoft software (inside a USB drive). Together they are used to wirelessly control telemeters and tBases allowing the user to:

- Change/configure the Channel (referred by this manual and ConfigSoft software as the communication frequency) of a telemeter and tBase.
- Run and provide diagnostic information about telemeters and tBase performance.



As mentioned, previously ONLY a single Configurator System is required to control all telemetry systems in a laboratory. In addition, it can also be used interchangeably between a Kaha mouse and rat telemetry system. For pre-existing Configurators with serial numbers 9787 and below that are in use with the Kaha Rat Telemetry Systems can still be used with the Kaha Mouse Telemetry System, but require a firmware and ConfigSoft software upgrade. Contact support@kahascience.com for assistance. The Configurator System is not required for data acquisition. Contact adi.to/support for any further assistance.

IMPORTANT: The ConfigSoft software supplied on the USB drive must be installed on a computer before connecting the Configurator hardware to the computer. It requires Windows 7, 8 or 10 (USB 2.0 or 3.0).

Quick Start for Mouse Telemetry

1) Installing ConfigSoft

1. Ensure system is either Windows 7, 8 or 10 (USB 2.0 or 3.0).
2. Insert the USB drive and open the ConfigSoft folder. There are two separate installers 32 bit and 64 bit. Please install the version compatible with your system. Open the appropriate folder and run setup.exe
3. Internet connection is necessary to access and install any drivers not already installed.

2) Configurator and tBase Setup

1. Attach aerial to rear of the Configurator.
2. Connect Configurator to computer via USB cable.
3. Place and position each tBase as recommended, which is on a flat non-metallic surface, away from any metal or other tBase for at least 10-15 cm, at least a minimum of 40 cm separating distance above or below another tBase (page 12).
4. Plug in each tBase to the appropriate power supply. Light on front will turn on (initially solid orange).
5. Connect tBases to a suitable PowerLab and LabChart data acquisition system using its BNC outputs. Each tBase has three analog BNC outputs, which automatically corresponds to the signals of the telemeter that will be paired later on.

Model #	Output 1	Output 2	Output 3
MT10B	Activity	Biopotential	Data Received

3) Pairing Telemeters and tBases via Configurator System

All telemeters and tBases are initially configured to Channel "Setup". For data collection, each telemeter and tBase needs to be configured and paired to one of 40 channels using the Configurator and ConfigSoft software. **ONLY** pair one telemeter with a tBase at any one time.

1. Telemeters do not need to be removed from their sterile packaging.
2. Place only one telemeter on the tBase (in its center and ensuring any other telemeters are away). The tBase status light should turn green.
3. Use ConfigSoft to change the Channel of the telemeter to the desired a data collection Channel, which the tBase light will then turn orange.
4. Use ConfigSoft to change the Channel of the tBase to match the Channel of the telemeter. The status light of the tBase should now return to green.

4) Implant Telemeters

Telemeters are normally shipped sterile and ready to implant. Surgical instructional videos, guides and techniques are available online at: www.adinstruments.com/support/kaha.

5) Acquiring Data

After successful surgical recovery, place the animal cage with the animal on the corresponding tBase. When the animal is placed on the tBase, the telemeter will be automatically powered and data transmission will occur. Continuous data collection and simultaneous charging is now possible (the Configurator is not required for data acquisition).

7) Further Questions and Support

If you have any additional questions and require further support, please contact your nearest ADInstruments representative or submit an inquiry via our website at <https://www.adinstruments.com/contact/technical-support>

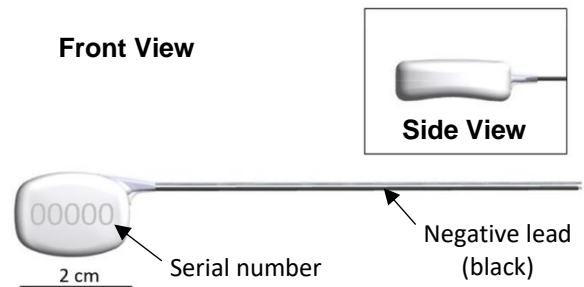
The Telemeter

Overview

Telemeters have a biocompatible ceramic case that safely encases and protects their electronics, as previously mentioned. Each telemeter also has its unique serial number engraved on it that is used for identification during later configuration and diagnostics.

The telemeter has a unique contoured shape with a curved convex front and a concave underside for better positioning in the mouse. Its body is designed to easily fit subcutaneously, with the concave underside sitting against the flank of the mouse and the convex front side next to the skin.

For the MT10B telemeter (as shown), which can measure a single biopotential signal between the positive and negative leads for applications including ECG, EMG and EEG, the polyurethane tubing around the negative lead is made black, while the tubing around the positive lead is transparent for ease of identification.



Telemeter Packaging and Channel

All telemeters are shipped sterile in a sterile sealed packaging (right) to be ready for implantation. The telemeter model and serial number are printed on the outside label of the transparent protective plastic case within the packaging. They are also factory set to Channel “Setup” and thus, **MUST** be configured to one of 40 communication Channels corresponding to its tBase before use. Each telemeter should have a different communication Channel when multiple telemeters are simultaneously used. When configuring multiple telemeters, we recommend you only turn on and configure the channel of one telemeter at any one time. There is no need to remove the telemeter from its sterile packaging to either turning it on or changing the channel until actual implantation.



Please note:

- It is highly recommended to write down the telemeter serial number and Channel setting before implanting the telemeter.
- Any other devices on the same Channel can interfere with the telemeter and/or tBase communication. Please check that only one telemeter and one tBase are on each Channel.
- Communication Channels of the current telemeters and tBases use similar frequencies as legacy Telemetry Research devices (telemeters, receivers or wireless power chargers) so these may also cause interference.

tBase

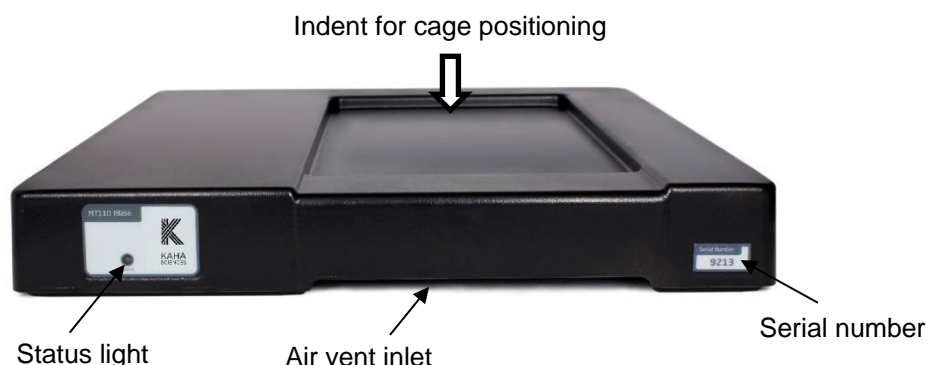
Overview

The tBase is both an inductive wireless power supply and receiver for the mouse telemetry. The top of the tBase has an indent (335mm (L) x 190mm (W) x 10mm (D)) which provides a guide for positioning of a mouse cage for optimal access to the inductive power field. It is recommended that only cages that fit within the indented area, with the cage base in contact with the surface of the indent, are used.

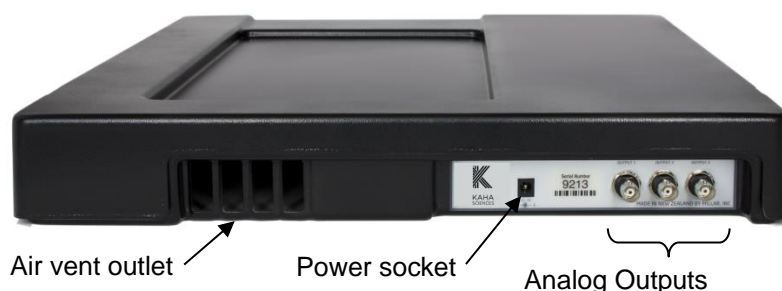
The tBase generates an inductive power field which extends approximately 7cm above the surface of the indent. When the mouse telemetry is within the tBase power field, the telemetry will be powered and data recorded. Only telemeters paired on the same transmission Channel as the tBase will communicate, be powered, collect and transmit data efficiently and accurately. No data will be recorded when the telemetry is not in the power field. For optimal powering, it is recommended that the cage is centred in the tBase indent.

Please note: The use of cages with base dimensions that exceed those of the tBase indent is NOT recommended and may compromise data collection.

Front View



Rear View



When initially setting up a laboratory with multiple tBases, it is important that only **ONE** tBase is turned on at a time. **The tBases and telemeters are all shipped set to Channel "Setup"**. Before using the telemetry system each tBase and mouse telemetry needs to be configured and paired to one of the 40 transmission Channels. It is important that only one tBase and one telemetry are used on any particular channel to prevent signal interference.

The recommended arrangement of multiple tBases in a laboratory is detailed on the next page. In particular, note the recommended distances from other tBase units and metal objects.

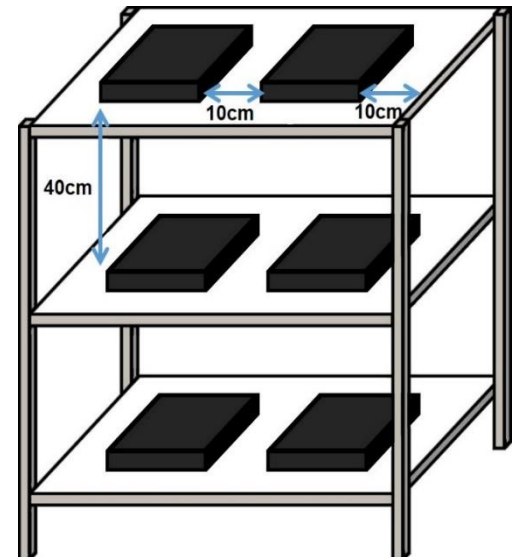
tBase Optimization

tBase Shelving Setup

The tBase provides power to the telemeter using an electromagnetic field generated above and below the tBase. For this reason, it is important that a tBase is **NOT** placed on a metal surface or above or below other tBases (unless 40 cm apart). We recommend the use of plastic shelving for your tBases. Multiple tBases should be arranged so that there is more than 10 cm horizontal and 40 cm vertical separation between them. If using shelving that has metal supports or frames then the tBases must be >10cm away from all metal (***please check the underside of the shelves for metal supports***). There should also be more than 10 cm separation between the top of a metal cage lid and any tBase on a shelf above.

If metal shelves are used, the tBase needs to be raised at least 10 cm from the shelf surface but still maintaining a vertical separation of at least 40 cm between tBases.

If the tBase shows a **solid red light**, then the tBases need to be separated further (vertically and horizontally) and/or move them further away from metal brackets, supports, cables or power packs. Turn the tBase off and then on to reset the tBase. If the problem continues, contact adi.to/support.



Example tBase arrangement on plastic shelves with metal framing.

IMPORTANT:

- Connect **ONLY** the supplied and labelled “TR181 or MT110” Power Supply to the power socket at the rear of the MT110 tBase. Using any other Power Supply will invalidate the warranty and may damage the tBase.
- **DO NOT** obstruct the air vents at the front and rear of the MT110. Ensure that any power cables and other items are kept clear of the air vents.

tBase Status lights

The status light at the front of the tBase provides information on the communication status between the tBase and the telemeter. They may flicker between solid green and solid orange during normal operation as the telemeter enters and leaves the power field with normal activity of the mouse i.e. mouse climbing on and off large objects in the cage.

Status Light	Information
Solid Green	The tBase is communicating with a telemeter on the same Channel
Solid Orange	The tBase is turned on but is not communicating with a telemeter
Solid Red	The tBase has detected an issue with the telemetry setup and has disabled the powering. If the status light is solid red, the power field of the tBase has been disabled and the telemeter will not be powered, and therefore no data will be recorded from the telemeter. This may be due to the tBase being placed too close to a metal surface or to another tBase. Move the tBase away from any metal and then reset by turning the power off and on. If the problem persists, record a diagnostic file in ConfigSoft while the tBase is showing a red status light and contact adi.to/support .
Flashing Red	The tBase is in diagnostic mode. No telemeter data will be sent out.

Analog Outputs and Calibration Values

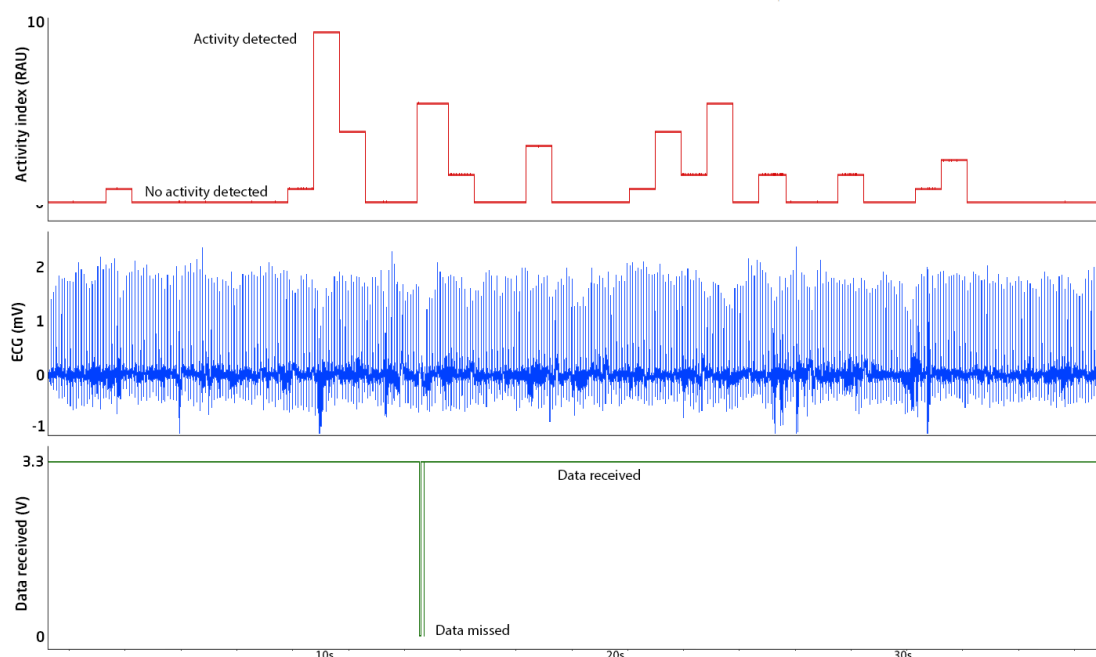
After pairing the tBase/telemeter, the analog outputs of the tBase will correspond to the following signal outputs:

Telemeter model	Output 1	Output 2	Output 3
MT10B	Activity	Biopotential	Data Received
Calibration values	0V = 0 RAU 3.84V = 10 RAU	2.048V = 0mV 4.096V = 2.5mV	~0V = no data received ~3.3V = data received

Activity: As the mouse moves in the power field the strength and orientation of the electromagnetic field it receives changes. These changes are detected by the tBase and collated every ~1 second to calculate an index of animal activity. The output is updated every second as ranges from 0V – 3.84V in 13 levels (see figure below). We recommend converting the voltage output to Relative Activity Units (RAU). The activity index can be used to determine relative changes in activity between two-time periods (e.g. night vs day).

Biopotential: This is your ECG, EEG or EMG signal. The potential difference between the two electrode leads is measured by the telemeter (sampling rate 2 kHz) and transmitted to the tBase. The tBase low-pass filters the signal at 1 kHz and reconstructs the analog signal.

Data Received: This provides an easy visual representation of when data is collected or when it has been missed. When the tBase is receiving data from a telemeter, the Data Received analog output will be ~3.3V. If no data is received from a telemeter for 12 milliseconds this output will drop to ~0V until data is received again (see picture below). The most likely cause of data not being received is that the mouse and telemeter have moved outside the inductive power field e.g. the mouse is hanging off the bars of the cage lid and is more than 7cm above the tBase surface. The Data Received output can be useful during data analysis to differentiate between real periods of low signal amplitude and missing data e.g. skipped beats in ECG recordings.



Example recording showing the Activity Index, Biopotential and Data Received outputs

Configurator System

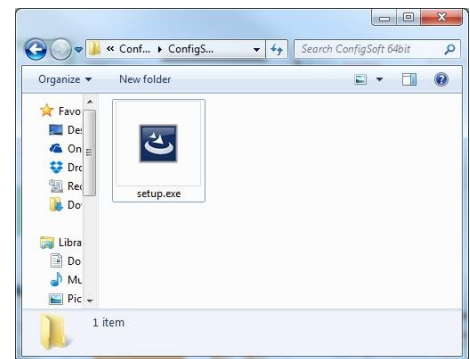
Configurator Software (ConfigSoft) Installation

The software requirements either Windows 7, 8 or 10 to operate and can be used with USB 2 and 3 ports. There are two separate installers on the supplied USB, each for different computer operating system. The version compatible with your system should be installed. Internet connection is necessary to access and install any drivers not already installed.



Please note: ConfigSoft must be installed on the computer before connecting the Configurator hardware. Any existing versions of ConfigSoft must be uninstalled prior to installation.

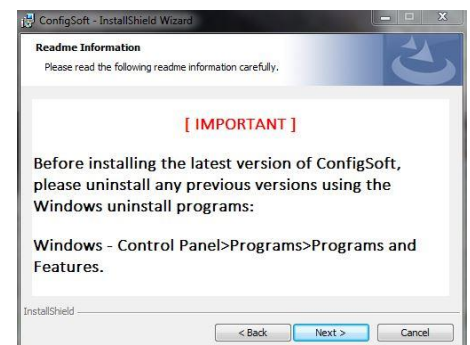
1. Connect the supplied USB drive containing ConfigSoft to your computer.
2. Open the folder "ConfigSoft 32 bit" or "ConfigSoft 64 bit" according to your Windows Operating System.
3. Double click on "Setup.exe" to start the installation.



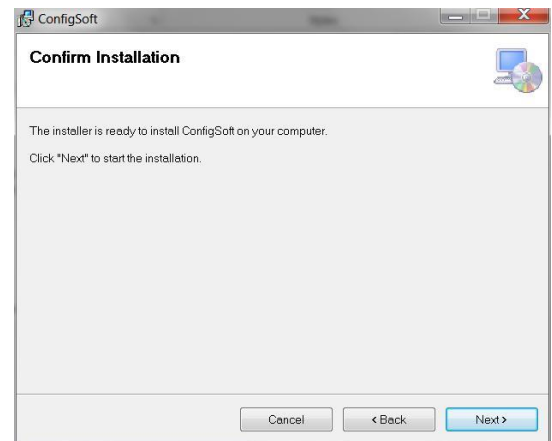
4. Once the welcome screen appears, follow the instructions for installation.



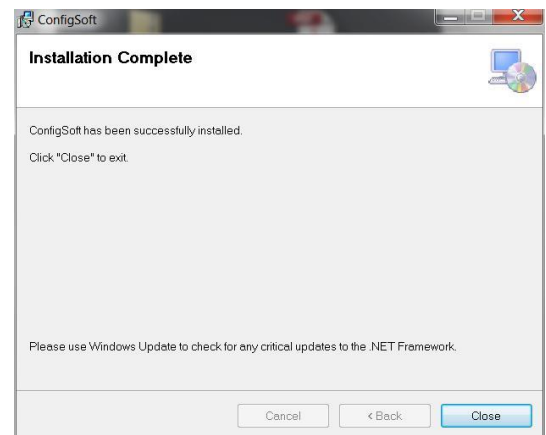
5. If reinstalling or upgrading the ConfigSoft it is important that any previous versions of ConfigSoft be first removed. If you need to remove the program, follow the instructions in this dialog to remove old versions. When ready click Next.



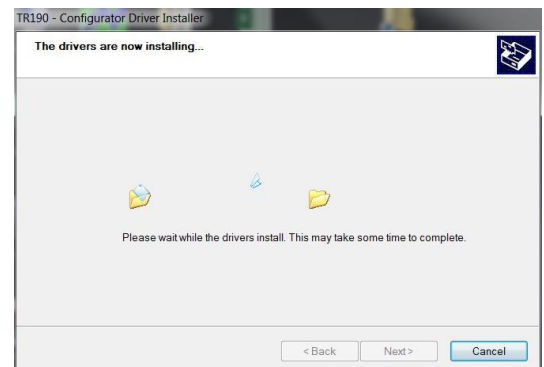
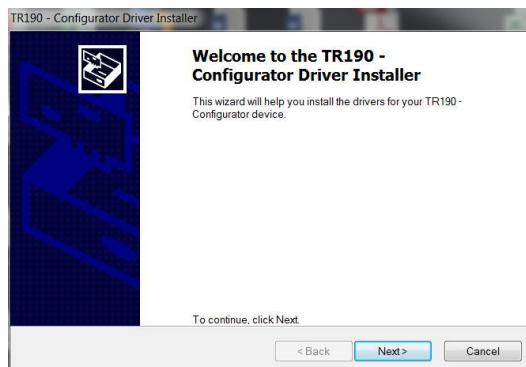
6. Confirm installation. Click Next.



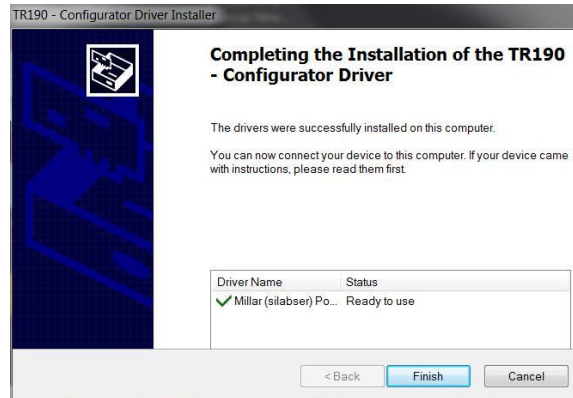
7. After the installation has been completed, Click Close.



8. The following window will automatically appear to install the driver for the TR190 Configurator if it is not already located on the computer. Click Next.



9. After successful installation of the TR190 Driver, Click Finish.

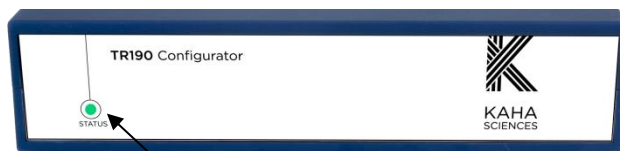


10. Installation of ConfigSoft and the TR190 Configurator drivers has been completed.

11. The Configurator hardware can now be connected. If there are any issues with the installation of ConfigSoft or the TR190 Configurator driver, please contact adi.to/support.

Configurator Hardware Connections

Front



Status light

Rear



Antenna connection

USB port

1. Attach the antenna to the rear of the Configurator.
2. After installation of ConfigSoft, connect the Configurator to the computer using the supplied USB cable. The status light on the front of the Configurator should glow **red** or **green** indicating that it is receiving power from the computer.

The status light on the front panel of the Configurator indicates the following information:

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

3. The computer will install any additional drivers and the status light should glow **green** indicating that the system is operational. If there are any problems, please contact adi.to/support.
4. The Configurator System is now ready for use with all your telemeters and tBases.

Configurator Software - Overview

ConfigSoft software can be either be launched from either the

- Desktop icon

OR

- Start>Programs>Kaha Telemetry>ConfigSoft



From the main menu the user has access to several options:

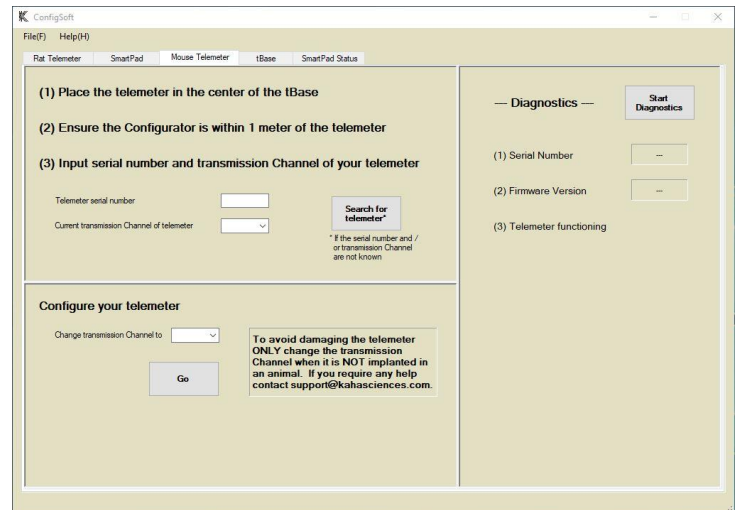
1. Rat Telemeter (not required for the mouse telemetry system).
2. SmartPad (not required for the mouse telemetry system).
3. Mouse Telemeter.
4. tBase.
5. Link to the Kaha Knowledge Centre (if connected to the internet), which will have a link to www.adinstruments.com/support/kaha.

After selecting an option, ConfigSoft will switch to another presentation dialog with the options as tabs and including another additional tab (SmartPad Status, which is not required for the mouse telemetry).

Mouse Telemeter

This tab allows you to:

- Search and detect nearby KAHA mouse telemeters.
- Configuring the transmission Channel of the detected KAHA mouse telemeter.
- Run diagnostics on the KAHA mouse telemeter.

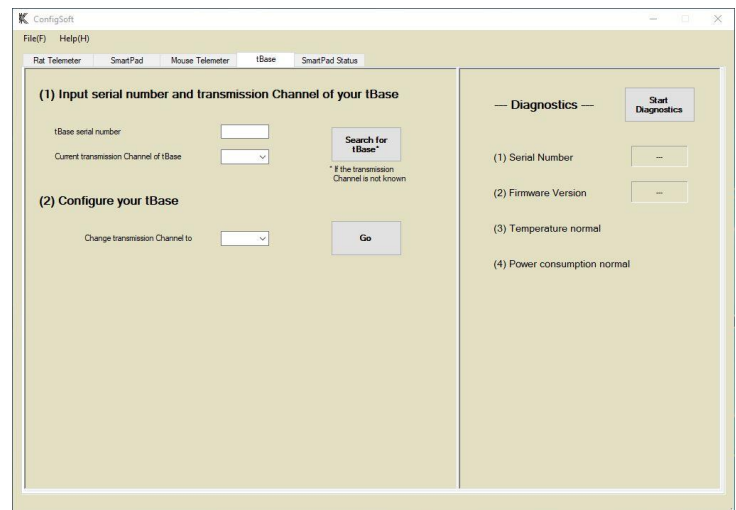


The screenshot shows the 'Mouse Telemeter' tab in the ConfigSoft application. The interface includes a menu bar with 'File(F)' and 'Help(H)'. Below the menu is a tab bar with 'Rat Telemeter', 'SmartPad', 'Mouse Telemeter' (selected), 'tBase', and 'SmartPad Status'. The main content area is divided into two columns. The left column contains three numbered instructions: (1) Place the telemeter in the center of the tBase, (2) Ensure the Configurator is within 1 meter of the telemeter, and (3) Input serial number and transmission Channel of your telemeter. Below these instructions are input fields for 'Telemeter serial number' and 'Current transmission Channel of telemeter', a 'Search for telemeter*' button, and a 'Go' button. A warning box states: 'To avoid damaging the telemeter ONLY change the transmission Channel when it is NOT implanted in an animal. If you require any help contact support@kahasciences.com.' The right column is titled 'Diagnostics' and contains a 'Start Diagnostics' button and three status indicators: (1) Serial Number, (2) Firmware Version, and (3) Telemeter functioning.

tBase

This tab allows you to:

- Search and detect nearby tBases. You will need to first input the serial number of the tBase.
- Configuring the transmission Channel of the detected tBase.
- Run diagnostics on the SmartPad.



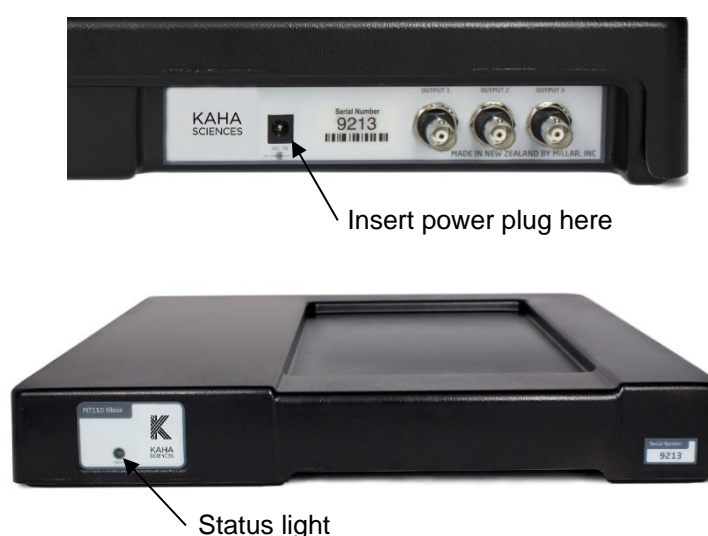
The screenshot shows the 'tBase' tab in the ConfigSoft application. The interface is similar to the Mouse Telemeter tab, with a menu bar and a tab bar where 'tBase' is selected. The left column contains two numbered instructions: (1) Input serial number and transmission Channel of your tBase, and (2) Configure your tBase. Below these are input fields for 'tBase serial number' and 'Current transmission Channel of tBase', a 'Search for tBase*' button, and a 'Go' button. A warning box is present: '* If the transmission Channel is not known'. The right column is titled 'Diagnostics' and contains a 'Start Diagnostics' button and four status indicators: (1) Serial Number, (2) Firmware Version, (3) Temperature normal, and (4) Power consumption normal.

Setting Up the System

Pairing a tBase and Telemeter

Before implanting a telemeter into an animal, the telemeter and the tBase, to be used with the telemeter, must have their Channels paired. Please ensure that only **one** tBase and **one** telemeter are being configured and paired at any one time. ***All tBases and telemeters are shipped on Channel "Setup" and should be changed to one of the 40 available communication Channels before animal implantation. The tBase and telemeter need to be within 1 metre of the Configurator during configuration.***

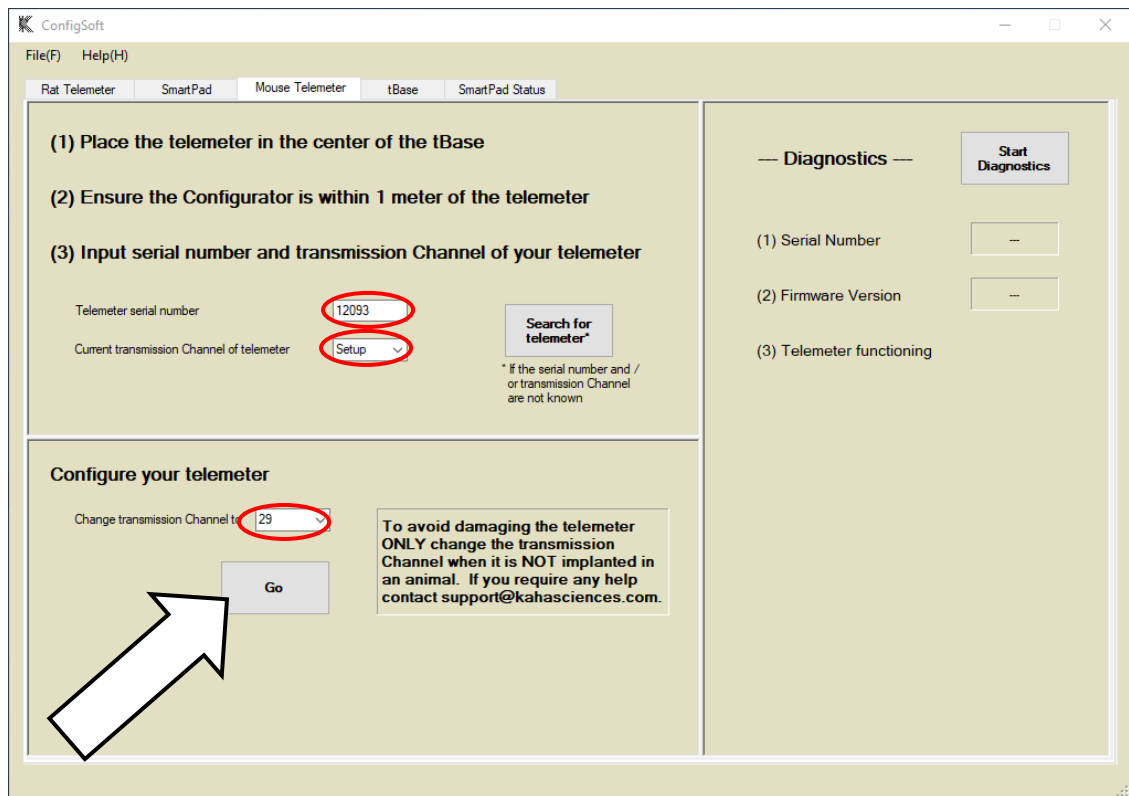
1. Turn on the tBase (Status light should be **orange**). If this is the first time the tBase has been turned on, it should be on the Channel "Setup". If not, use the Configurator System to configure the tBase Channel to "Setup" (see page 22 for details).



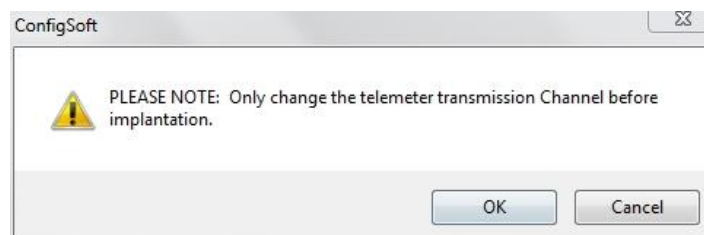
2. Place a telemeter (in its sterile packaging) in the centre of the indent of the tBase. The tBase will automatically start powering the telemeter as both the tBase and telemeter will be on Channel "Setup". The tBase status should turn **green**.
3. Using the Configurator system, first change the Channel of the mouse telemeter to one of the 40 data collection Channels (detailed instructions in the next two sections). The tBase status light should now be **orange**. Remove the mouse telemeter from the tBase.
4. Configure the tBase to the same data collection Channel as the mouse telemeter using ConfigSoft (detailed instructions in the next two sections). Place the telemeter on the tBase, the status light should be **green**. Your system is now paired and ready for use.

Changing Telemeter Channel

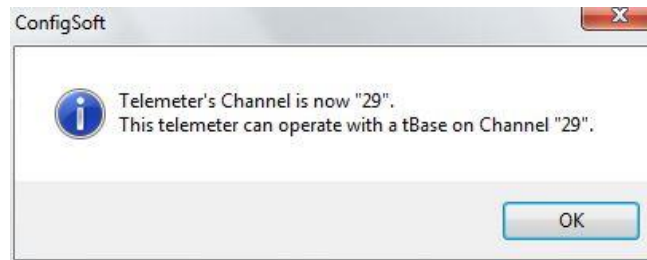
1. Before implanting the mouse telemeter, place the mouse telemeter in the center of the indent of the tBase configured to the same Channel (first use Channel = "Setup"). Ensure the telemeter and tBase are within 1 metre of the Configurator. The tBase status light should be **green** to show the telemeter is powered and communicating with the tBase.
2. Open ConfigSoft.
3. Click on the "Mouse Telemeter" tab.



4. Enter the serial number of the telemeter. The number is on the outside of the telemeter packaging or engraved on the telemeter.
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 the "Configure your telemeter" section.
7. Click Go to activate the new Channel.
8. A dialog will pop up with "Only change the telemeter transmission Channel before implantation". 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.



Failed telemeter Communication with Configurator System

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

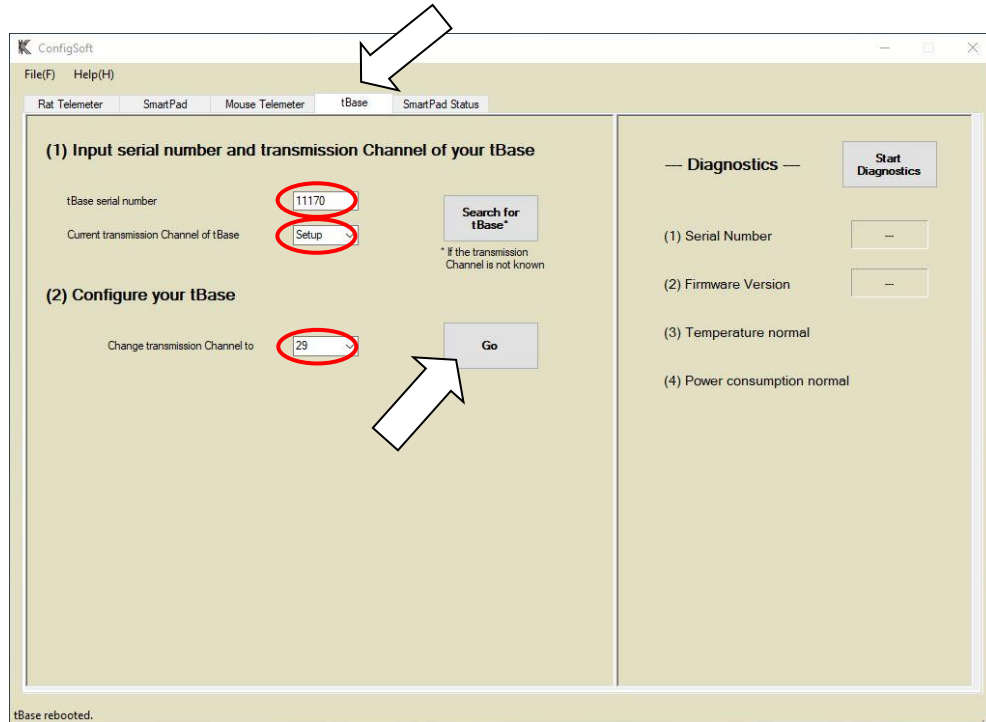


Solution: Click OK and do the following, then try again.

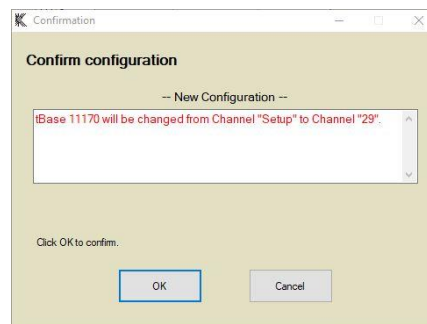
- Check that you have entered the correct telemeter Serial number.
- Check that you have entered the correct telemeter Channel number.
- Make sure that the telemeter is on a tBase set to the same Channel
- Move the telemeter and paired tBase closer to the Configurator
- Check you only have one tBase/telemeter set to the same Channel
- Move the telemeter to a different position on the tBase

Changing tBase Channel

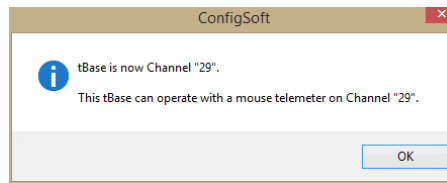
1. To change the tBase Channel and pair this with a telemeter, click on the “tBase” tab in ConfigSoft.



2. Enter the serial number of the tBase (found on the front and rear of the tBase).
3. Enter current Channel number of the tBase (first use: Channel = “Setup”).
4. Under “Configure your tBase”, enter or select a new Channel number for the tBase (this should be same as telemeter being used).
5. Click Go to activate the new Channel.
6. Click OK to confirm your choice.



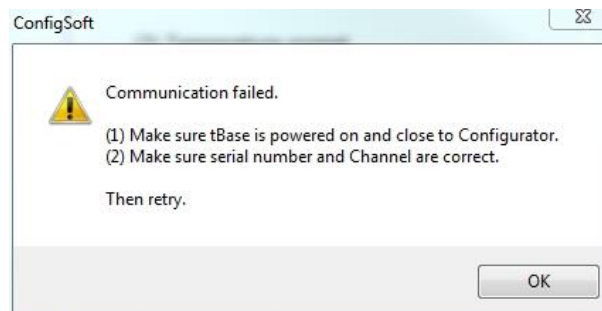
7. The tBase status light will flash red for a few seconds before a message confirming that the tBase channel has been changed appears. Record the tBase serial number and new Channel number for future reference.



8. If a telemeter on the same Channel is placed on the tBase, the Status light should change to green. The telemeter and tBase are now on the same Channel, paired, and able to communicate for data collection and transmission.

Failed tBase Communication with Configurator System

If the Configurator cannot communicate with the tBase the following error message may appear.



Solution: Click OK and perform the following, then retry:

- Check that the light on the front of the tBase is orange.
- Check that you entered the correct Serial and/or Channel numbers.
- Move tBase closer to Configurator.
- Check you only have one tBase set to the same Channel.

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

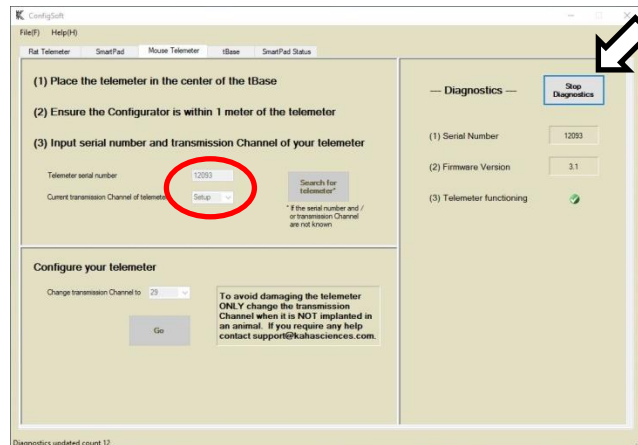
Your Kaha Mouse Telemetry System is now configured and ready for use.

Diagnostics

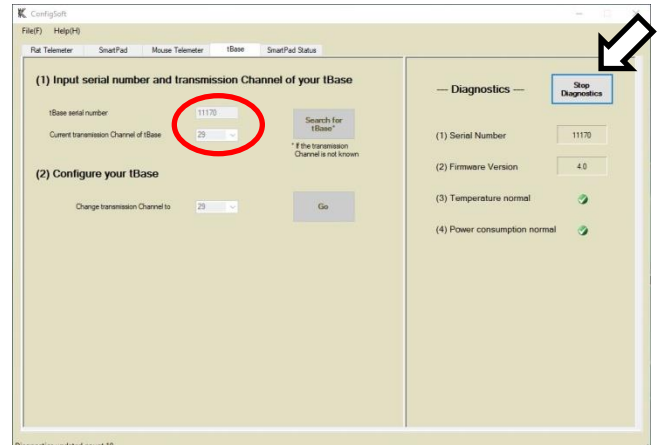
Mouse Telemeter and tBase Diagnostics

Using the Configurator System, the user can investigate and diagnose the mouse telemeter and tBase. The serial number and Channel needs to be confirmed before running the diagnostics.

Mouse Telemeter diagnostics



tBase diagnostics



The “Search for telemeter” function in Mouse Telemeter tab can be used to find the serial number of an implanted telemeter if this was not recorded prior to implantation. Similarly, the “Search for tBase” function in tBase tab will find the Channel of a specific tBase. To run diagnostics for the mouse telemeter or tBase, enter the Serial number and the Channel number in the “Mouse Telemeter” or “tBase” panel, and press the “Start Diagnostics” button. Diagnostics will additionally provide information on the temperature and power consumption of the tBase.

tBase Temperature

- ✓ = the temperature of the tBase is at acceptable levels.
- ✗ = the temperature is above acceptable limits. Contact adi.to/support.

tBase Power Consumption

- ✓ = tBase power consumption is normal.
- ✗ = Excess power consumption has been detected. The Status light on the front of tBase will be red. A possible cause is that the tBase may be too close to a metal surface or another tBase.

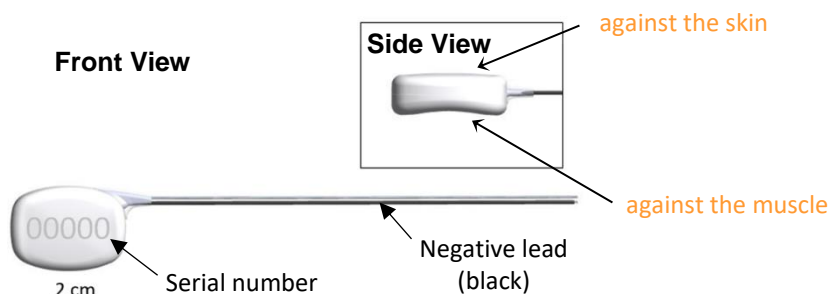
Diagnostics Files

When sending emails to adi.to/support for troubleshooting, you may be asked to send a diagnostics file. To save a diagnostic file, choose to save the file after pressing “Start Diagnostics” when either diagnosing a mouse telemeter or a tBase. ConfigSoft will ask you to confirm the name and location for the log file. The default filename includes the telemeter or tBase serial number and the date and time the diagnostics was started. The log file and display are both updated every 1 s. A count of the updates is shown in the bottom left hand corner of the window. Diagnostics will continue to run until you press “Stop Diagnostics”. The log file is then automatically saved. If you choose to save a log file you will not be able to stop the diagnostics for at least 2 minutes.

Please note: that you cannot record data from your telemeter using a tBase that is in Diagnostics mode (the status light flashes red and a saw tooth pattern will output from the tBase analog outputs).

Usage and Maintenance

Positioning the Telemeter during Surgery



As previously mentioned, the telemeter has a unique contoured shape with a curved convex front and a concave underside for better positioning in the mouse. The telemeter body is designed to easily fit subcutaneously, with the concave underside sitting against the flank of the mouse and the convex front side next to the skin.

The recommended optimal site for telemeter placement is on the flank/side of the animal between the front and the rear limbs with the concave surface of the telemeter against the body. Placement on the right-hand side of the mouse means the electrode leads will exit from the top corner of the telemeter body and can be tunneled over the shoulder for ECG placement or to the skull for measurement of EEG.

Ideal Powering and Signal Maximization

The tBase provides an electromagnetic field to power the mouse telemeter. This field provides effective powering of the telemeter up to 7cm vertical distance from the bottom of the indent on the tBase. However, when the telemeter body is more than 7cm above the tBase, the telemeter will not be powered, and data collection will not be available. This can occur when the mouse hangs from the wire cage lid or is physically sitting more than 7cm above the tBase.

Powering may not be as effective if the telemeter is placed on the back of the animal or up near the shoulders as that creates additional distance from the tBase, especially when the animal is up on their hind legs. More information and surgical videos are available online at the Kaha Knowledge Centre (www.adinstruments.com/support/kaha).

Please note: It is also strongly recommended that bedding within the cage is kept to a minimum and tall items, which the mouse can climb on top of, are removed. For example, large enrichment tubes, multi-level mouse houses or other toys with elevated flat surfaces should be avoided.

Biopotential Lead Placement

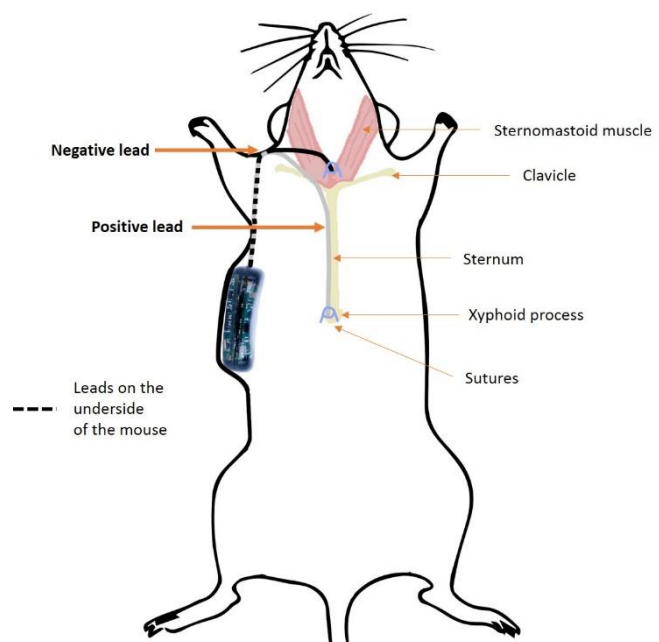
The MT10B Mouse biopotential telemeters are supplied with 8cm long coiled stainless steel bipolar electrodes suitable for measurement of biological electric potential signals including ECG, EEG and EMG. To reduce noise in the recorded signal it is recommended that the electrode leads be trimmed to length at the time of surgery rather than coiling any excess wire. It is important however to allow some extra length in the electrode leads to allow for animal movement. For ease of identification, the polyurethane tubing around the negative lead is black, while the tubing around the positive lead is transparent.

After trimming the electrode leads to the desired length, it will be necessary to expose the coiled stainless-steel electrode within the lead tubing. Care must be taken to avoid damaging the wire as this can lead to wire breakages and poor signal quality during recordings. The recommended way to expose the electrode wire is to use a surgical microscope and carefully trim the tubing from around the wire. Do not trim, stretch or disturb the wire coil within 2.5 cm of the telemeter body.

The stainless-steel electrodes are coiled for maximum strength and flexibility. The coil can slip out of a suture however, so it may be useful to carefully stretch the coils at the tip of the electrode to allow a suture thread to pass between the coils. It is not recommended that sutures be placed around the leads other than around the point of contact with the tissue as this may provide a stress point on the leads and cause them to break. More information and surgical videos are available online at www.adinstruments.com/support/kaha.



Example placement of electrode leads for recording of high quality ECG



Telemeter Care and Handling

All telemeters are shipped sterilized using ethylene oxide gas sterilization and **can be implanted without the need for further sterilization**. Telemeters will remain sterile as long as the pouch is intact and not compromised. It is recommended that they remain in their original packaging until surgical implantation.

However, if the telemeters have been accidentally removed from the sterile packaging prior to implantation, or if they come in contact with non-sterile surfaces during surgery, they can be re-sterilized:

Chemical Sterilants

Glutaraldehyde may be used to sterilize the telemeters. Glutaraldehyde (Fisher Scientific) must be diluted to 2% in sterile pyrogen-free water or sterile 0.9% saline before use. Check your local chemical supply company for availability. Do not use glutaraldehyde solutions containing surfactants (i.e. do **not** use Cidex 7, Cidex Plus 28 Day or Metrocide 28) or hydrogen peroxide. Suitable products are in the table below:

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

IMPORTANT:

- Telemeters sterilized with a chemical sterilant should always be washed thoroughly in sterile saline before implantation to remove all traces of the sterilant.
- **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 adi.to/support before using any product other than the approved products list above.
- Products with similar names are available, but may not be suitable. Please use only products specified or contact adi.to/support for clarification.

Ethylene Oxide Gas Sterilization

Telemeters are suitable for Ethylene Oxide sterilization as long as they are not subjected to temperatures above 60°C.

IMPORTANT:

- Under no circumstances should the telemeter be autoclaved or subjected to temperatures over 60°C as this will damage the telemeter.
- Do not sterilize by radiation (gamma or e-beam), plasma, alcohol, peroxide or formaldehyde vapor solutions. This will damage the telemeter.

Customers are liable for product replacements if recommended products and instructions are not used or followed. If there are any questions about a chemical or procedure, please contact adi.to/support.

Technical Specifications

tBase Technical Specifications

tBase	MT110
tBase functions	Provides power only to mouse telemeters using inductive wireless charging, outputs standard analog voltage compatible with any data acquisition system (BNC), has a built-in fan for optimal temperature operation.
Weight	3.0 Kg
Dimensions	400(w) x 450(d) x 65(h) mm
Cage platform dimensions	190(w) x 335(d) mm
Power input	100-240 V, 50-60 Hz
Max Power draw	90W
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 mouse telemeters.

Biopotential Input range	+2.5 mV
Biopotential Resolution	12 bit A/D
Biopotential High pass characteristics	AC coupled, single pole, -3dB point at 2 Hz
Biopotential Low pass characteristics	AC coupled, single pole, -3dB point at 440 Hz
Biopotential Electrode leads	8cm length, coiled stainless steel
Biopotential Electrode diameter	0.42 mm
Temperature operating range	34 to 41 degrees Celsius
Sampling frequency	2000 Hz
Low Pass filtering by tBase	Cut off frequency = 1000 Hz
Transmitted signal	Fully digital at 2.4 GHz
Channels	40 transmission frequencies are available, user set
Minimum animal weight	22 grams
Outer material	Ceramic (telemeter body) and polyurethane (lead-set)
Volume	1.8 cc
On-off mechanism	Powered when placed on the tBase and deactivated when removed from the tBase.
Calibration	No user intervention required (calibration values stored within each telemeter).
Analog output calibration values	Activity: 0V output = 0 RAU 3.84V output = 10 RAU Biopotential: 2.048V output = 0mV input, 4.096V output = 2.5 mV input Data received: ~0V output = 0 (no data received), ~3.3V = 1 (data received)

Frequently Asked Questions.....

Would the animal be harmed by staying in the tBase powering field?

There are no known biological effects of the inductive field. Studies have shown that field strengths much higher than generated by the Kaha tBase have no effect. The level of magnetic field is quite low and remains useable only ~7 cm above the tBase.

How many animals can be monitored at one time?

Each telemeter sends its signal on one of 40 unique transmission Channels. Therefore, up to 40 telemeters and animals can be monitored at one time (on separate tBases).

Can I use the Kaha Mouse Telemetry System alongside the Kaha Rat Telemetry System?

Both the Kaha Rat Telemetry System and Kaha Mouse Telemetry System can be operated on any of the 40 independent data collection Channels with minimal interference between animals. Therefore, both systems can be operated side-by-side to monitor up to a total of 40 rats or mice, or a combination of both rats and mice, at any one time. If you have an existing Configurator with a serial number 9787 or less, it will require a firmware, and possibly software, update before use with mouse telemeters (contact adi.to/support).

Is there any interference between mouse telemeters?

No, as long as each telemeter is set to use a different Channel, they use separate transmission frequencies. No shielding is required between cages, proximity is not a problem.

Do I need to use special mouse cages with the tBase?

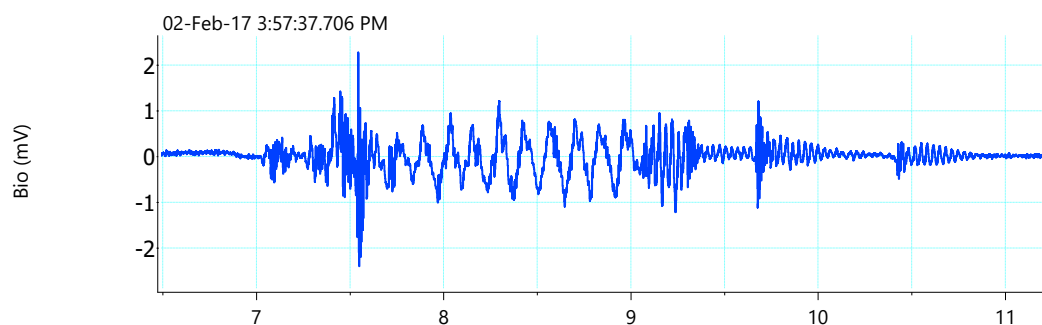
Special caging is not required for use with this system. The only limitation is that the cage base must sit on the surface of the tBase indent. The indent of the tBase for the mouse cage is 190mm x 335mm and is compatible with any non-metallic cage bottom which fits these dimensions.

How long can a mouse telemeter be kept on a shelf?

The shelf life of the telemeters is 1 year. The telemeter materials encapsulating the electronics may be affected by UV light, so it is important that the telemeter be stored in a cool dark place. If stored on the shelf for longer than six months, it is recommended to gas re-sterilize the telemeter.

How can I check that the MT10B mouse telemeter is functioning before implanting it?

Telemeters should turn on and begin transmitting data when placed (in the sterile packaging) on a tBase set to the same channel (tBase status light shows green). Telemeters and tBases are shipped on the Setup channel and should be changed to one of the 40 recording channels before use. To further check the telemeter is functioning, it can be gently shaken in its packaging while still on the tBase. The biopotential signal recorded from a data acquisition system connected to the tBase BNC output 2 will show deflections as the electrode leads move inside the packaging (see example below).



How long can the telemeter be implanted for?

The telemeters are designed to be implanted subcutaneously and receive power wirelessly from the tBase. This means the implantation life is not limited by battery life and should be expected to function for a minimum of 90 days.

The MT10B mouse telemeter is defined as a "single use" telemeter and does not have a battery. Why can't it be re-used?

The MT10B telemeter has been designed to be single use and all testing has been done with this in mind. No testing or validation has been done for re-use of the MT10B telemeter. Re-use of the MT10B telemeter is not recommended particularly because the electrode leads are not filled and tissue contamination into the tubing will occur over time when implanted. It will not be possible to clean this sufficiently to allow re-implantation.

Further questions?

Kaha is proud to offer unlimited technical support and advice to all its customers. Register to access our free online Knowledge Centre (www.adinstruments.com/support/kaha) for surgical recommendations and **hardware troubleshooting** advice. If you have any further questions, our team of engineers and physiologists can advise on specific applications and equipment configurations. Please do not hesitate to contact us at support@kahasciences.com.

