



emkaPACK non-invasive telemetry transmitter

user manual

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product information and technical support

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geographical region of use

emkaPACK transmitters are specific to the geographical region of use. The part number (P/N) on the back of the device (see figure) indicates the geographical region of use of your device (see table below).



| geographical region of use | part number (p/n) | compliance notice |
|----------------------------|-------------------|---|
| Europe only | TLE-E03 | |
| US and Canada only | TLE-E03-US | FCC ID : V9VTLEE03US IC : 7689A-TLEE03US |

for use in US only

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. 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, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and receiver
- connect the equipment to an outlet on a circuit different to that of the receiver
- consult **emka** TECHNOLOGIES

You do not need to apply for a license to operate the **emkaPACK** non-invasive telemetry transmitter. Do not attempt to open the **emkaPACK**.

Any changes or modifications in the **emkaPACK** that are not expressly approved by **emka TECHNOLOGIES** could void your authority to operate this equipment.

emka TECHNOLOGIES SA, 59, boulevard Général Martial Valin, 75015, Paris, France, declares that device TLE-E03-US complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) the device may not cause harmful interference, and (2) the device must accept any interference received, including interference that may cause undesired operation.

for use in Canada only

emka TECHNOLOGIES SA, 59, boulevard Général Martial Valin, 75015, Paris, France, déclare que l'appareil TLE-E03-US respecte la réglementation CNR-210 de l'Industrie du Canada. L'utilisation de ce dispositif est autorisée seulement aux deux conditions suivantes : (1) il ne doit pas produire de brouillage, et (2) l'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

Attention: Tous changements ou modifications sur l'**emkaPACK** qui ne sont pas expressément approuvé par **emka TECHNOLOGIES** pourrait annuler votre autorité à utiliser cet appareil.

emka TECHNOLOGIES SA, 59, boulevard Général Martial Valin, 75015, Paris, France, declares that the device TLE-E03-US complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) the device may not cause harmful interference, and (2) the device must accept any interference received, including interference that may cause undesired operation.

Caution: Any changes or modifications in the **emkaPACK** that are not expressly approved by **emka TECHNOLOGIES** could void your authority to operate this equipment.

important notices

disclaimer

The hardware is exclusively designed for scientific research on the physiology of laboratory animals. When this equipment is used, research animals should remain confined to their usual laboratory cages.

All the hardware and software materials described in this user manual are not intended to be used, and should not be used in human experimentation or applied to humans in any way.

verification

emka TECHNOLOGIES hardware and software are extensively tested and calibrated before leaving our factory or warehouse. Researchers should independently verify the basic accuracy of materials delivered.

warranty

All material delivered by **emka** TECHNOLOGIES has a warranty against defects in material and workmanship for a period of one year from the date of shipment (as evidenced by receipts or other documentation). **emka** TECHNOLOGIES will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty covers parts and labor.

The warranty becomes invalid if the material is not used in accordance with this user manual.

emka TECHNOLOGIES believes that the information provided in this document is accurate. Our document has been reviewed for technical accuracy. In the event that technical or typographical errors exist, **emka** TECHNOLOGIES reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should contact **emka** TECHNOLOGIES if errors are suspected.

safety warning

If material is not used in accordance with this user manual, electrical protection provided by the hardware material may be impaired.

This manual contains all information about which precautions to take to avoid injury due to electrical shock. Please read this manual before using the **emka**PACK non-invasive telemetry transmitter.

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about this manual

This document tells you how to use the **emkaPACK** for the acquisition of ecg and activity data.

For customers new to telemetry, chapter 1 is a brief overview of the telemetry system from emka TECHNOLOGIES.

chapter 2 describes your **emkaPACK** transmitter, while chapter 3 'setting up the **emkaPACK** transmitter' and chapter 4 'running sessions' provide practical guidance on using the **emkaPACK** transmitter. chapter 9 'recommendations' contains important information concerning which the types of batteries to use with your **emkaPACK** transmitter.

If you have any questions or encounter any problems, the solution is likely to be found in this manual, in particular chapter 7 'frequently asked questions' or chapter 8 'troubleshooting'.

conventions

The different types of information given in the text are described below.



note: note.

Text in this format alerts you to a note, comment, or specific information.



technical note: technical note.

Text in this format alerts you to a note, comment, or specific information of a technical nature.



important! important note.

Text in this font alerts you to important information.



caution! caution note.

Text in this font warns you of precautions to take to avoid danger, injury, the loss of data, or a system crash.

equipment symbols

The different types of symbols on the device are described below.



Attention, consult accompanying documents.



Battery

related documentation

The following documents may also be of interest to you.

emkaPACK non-invasive telemetry system application note - for an overview of telemetry

emka^{PACK} *telemetry receiver user manual*

iox2 user manual - iox2 is **emka** TECHNOLOGIES' software solution for acquiring, analyzing and storing data

ecgAUTO user manual - ecgAUTO is **emka** TECHNOLOGIES' ecg analysis software

chapter 1 the telemetry system

The telemetry system from **emka TECHNOLOGIES** is intended for use in preclinical research, primarily toxicology and safety pharmacology studies.

It is a non-invasive, or external, system that acquires biological data from large subjects such as dogs and non-human primates then transmits these data wirelessly to a data acquisition station.

The different components of the telemetry system are shown in figure 1. This is a standard set-up consisting of one antenna per cage and a small number of subjects (to aid understanding, only key components and connections are shown).

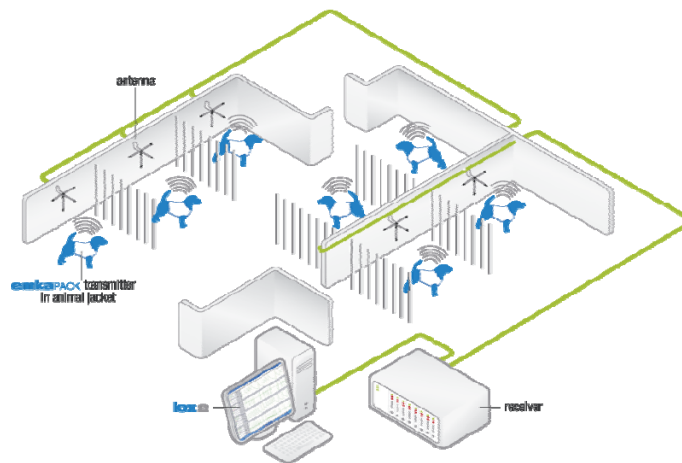


figure 1 a standard telemetry system installed by emka TECHNOLOGIES

The different components of a standard telemetry system are as follows:

emkaPACK transmitter

The **emkaPACK** transmitter is a compact and durable unit that fits neatly into a jacket pocket on the back of the subject. Each **emkaPACK** transmitter collects, conditions, converts (to digital), and transmits physiological signals on a specific frequency channel.

antenna

receives the transmitted signals, and is connected to the receiver module, directly or via an antenna network.

receiver mainframe

houses and powers the receiver modules

emkaPACK receiver module

Each is tuned to a specific frequency channel, and forms a pair with a specific **emkaPACK** transmitter. The modules slot inside the receiver mainframe.

versatile antenna adapter (VAA) (not shown on figure)

One or more VAAs combine to form an antenna network. Their role is to combine and/or split the radio signal going from one or more antennas to one or more

receiver modules. This allows greater flexibility when planning experiments (for example, with a VAA, a particular **emka**PACK can be used in different pens in different recording sessions).

workstation

every setup contains at least one workstation equipped with a data acquisition card and software for acquiring, analyzing and storing data. In figure above, **iox2** is used for acquisition, analysis and storage. For ecg data, advanced analysis can be carried out with **ecg**AUTO software.

chapter 2 emkaPACK transmitter

The **emkaPACK** transmitter performs collection, conditioning (including amplification), analog-to-digital conversion, and transmission of ecg and activity.

It runs on two AA/R6 alkaline batteries providing continuous acquisition of 7-lead ecg and activity data for an average of 80 hours.

With regard to battery choice:

- it is strongly recommended to avoid high-power batteries (see chapter 9).
- it is preferable to use single-use (disposable) rather than rechargeable batteries (see FAQ "can I use rechargeable batteries?" in chapter 7).

The **emkaPACK** transmitter does not have a power switch. It is automatically switched on and off when the ecg cable is connected and disconnected.

2.1 description

2.1.1 emkaPACK number

The corresponding receiver module has the same number (figure 2).

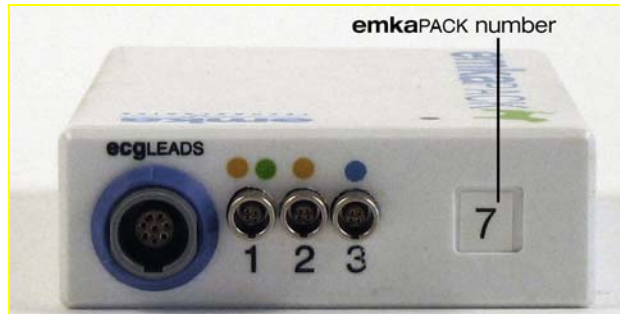


figure 2 emkaPACK number

2.1.2 serial number (S/N)

A unique serial number (S/N) is found on the back of each **emkaPACK** (figure 3).

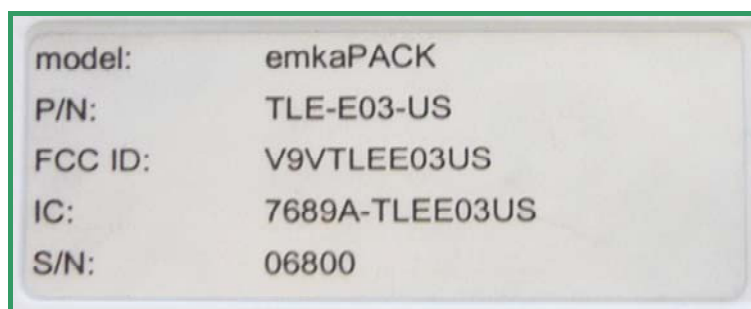


figure 3 emkaPACK transmitter serial number (S/N)

2.1.3 ecg connector

The ecg cable is connected to the **ecgLEADS** connector (figure 4).

2.1.4 primary connectors

These connectors are used to connect to modules for the acquisition of physiological signals other than ecg and activity.

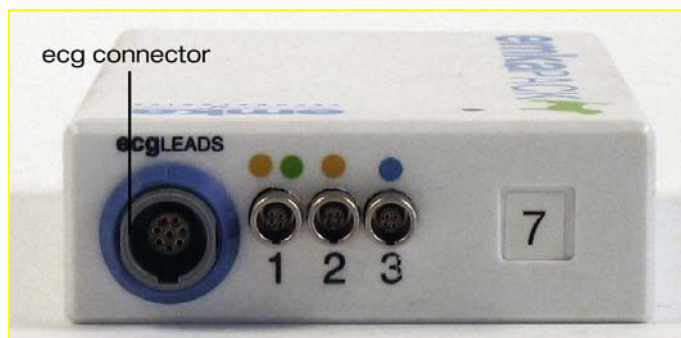


figure 4 ecg connector and primary connectors

2.1.5 secondary connectors

These connectors connect to modules for the acquisition of physiological signals other than ecg and activity (figure 5).

These connectors are not fitted on the **emkaPACK** as standard, because they are only for use with modules by **emka TECHNOLOGIES**. Nevertheless, markings are provided on the **emkaPACK** for customers who purchase the modules (figure 5). (In this case, the connectors may be fitted by customers themselves or by **emka TECHNOLOGIES**.)

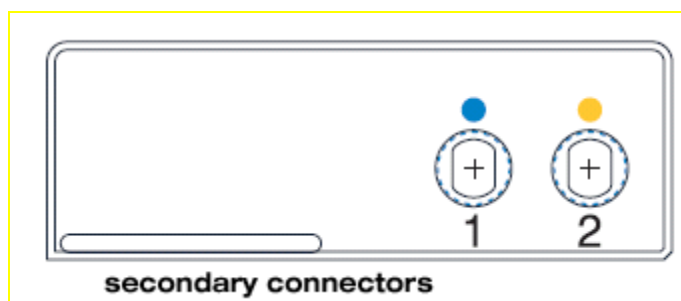


figure 5 secondary connectors (markings)

2.1.6 led

The led (figure 6) indicates the progress of the boot-up procedure.

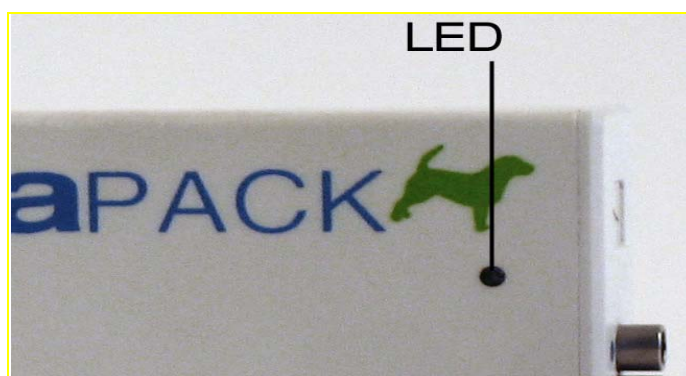


figure 6 emkaPACK transmitter and led

2.2 acquired parameters

2.2.1 ecg

The **emkaPACK** is used to obtain ecg data from large animals, such as dogs, primates and pigs. Three configurations are possible

- 1-lead ecg, using a 3-wire ecg cable
- 6-lead ecg, using a 4-wire ecg cable, for obtaining the standard leads, namely three Einthoven bipolar leads (I, II, III) and three Goldberger unipolar leads (aVR, aVL, aVF)
- 7-lead ecg, using a 5-wire ecg cable - 6-lead ecg as above plus one unipolar chest lead (Wilson lead)

The colors used for the different wires are those defined by standards (Table 1).

| location | IEC (Europe) | AAMI (US, Japan) |
|----------------|---|---|
| right arm (RA) | red | white |
| left arm (LA) | yellow | black |
| right leg (RL) | black | green |
| left leg (LL) | green | red |
| chest lead | variable (gray for emka TECHNOLOGIES) | variable (gray for emka TECHNOLOGIES) |

table 1 standards for color coding for ecg electrodes

When placing an order for an **emkaPACK**, customers must specify which ecg configuration they intend to use because the internal software of the **emkaPACK** must be configured. In addition, the appropriate ecg cable is supplied.

2.2.2 activity

The 3-axis accelerometer inside the **emka**PACK transmitter measures movement in each axis every 2 ms.

The **emka**PACK calculates an activity signal (Act) for intervals of 192 ms as follows.

$$Act = \sqrt{\left| \varepsilon_x \right|^2 + \left| \varepsilon_y \right|^2 + \left| \varepsilon_z \right|^2}$$

with $\varepsilon_x = x_n - \bar{x}_n$

$\varepsilon_y = y_n - \bar{y}_n$

$\varepsilon_z = z_n - \bar{z}_n$

where x_n is the x-axis value for acquisitions $n \rightarrow n+95$

where y_n is the y-axis value for acquisition $n \rightarrow n+95$

where z_n is the z-axis value for acquisition $n \rightarrow n+95$

chapter 3 setting up the **emkaPACK** transmitter

3.1 what is supplied

- ecg cable containing 3, 4 or 5 wires, as requested by the customer. Electrodes provided with 4-and 5-wire cables are color coded in accordance with IEC standards (on request, **emka** TECHNOLOGIES will supply cable color coded according to AAMI standards).
- electrode connectors (Comepa) - both banana and clip connectors are supplied (figure 7). The clip connector is inserted around the banana connector. Therefore, simply remove the clip connector if you want to use the banana connectors.

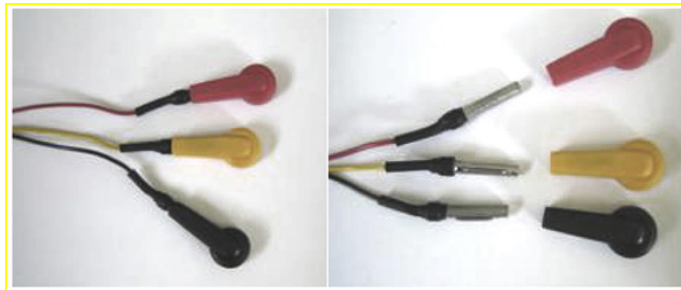


figure 7 clips and banana connectors for ecg measurements

3.2 setting up the **emkaPACK** transmitter

The setup involves calibration only.

3.2.1 calibration of ecg signal

The ecg measurement chain is factory calibrated and temperature compensated.

You simply enter the two pairs of calibration values directly into your data acquisition software:

| | low | high |
|-----------------------------|-----|------|
| Physical value (mV) | -5 | 5 |
| Output signal amplitude (V) | -5 | 5 |

table 2 calibration values for ecg signal

If you are using iox2, this 'manual calibration' is done in 'two-points calibration (manual)'.

To perform calibration, you can also use a device that simulates ecg output. You may use the ecg calibrator from **emka** TECHNOLOGIES for this purpose (sold separately).

3.2.2 calibration of activity signal

The integrated activity measurement system is factory calibrated and temperature compensated.

You simply enter the two pairs of calibration values (voltage and physical quantity) directly into your data acquisition software:

| | low | high |
|-------------------------------------|-----|-------|
| Physical value (m.s ⁻²) | 0 | 1 |
| Output signal amplitude (V) | -5 | -1.45 |

table 3 calibration values for activity signal

If you are using iox2, this 'manual calibration' is done in 'two-points calibration (manual)'.

chapter 4 running sessions

This chapter describes how to run a session for the acquisition of 7-lead ecg and activity in dogs.

It is assumed that the telemetry setup also includes iox2 (a software application for acquiring, analyzing and storing data) and you are using clothing from Lomir (custom-designed for the **emkaPACK**).

4.1.1 requirements

- ecg cable (supplied)
- banana and clip connectors (supplied)
- adhesive electrodes (available from **emka TECHNOLOGIES** separately)
- clippers
- gauze sponge
- alcohol for disinfecting the skin
- white tape
- undershirt
- jacket
- self-adherent bandaging (optional), such as Vetrap™ (3M, Bracknell, Berks, United Kingdom)

4.1.2 running a session

1. Insert new batteries.

subject preparation - place the electrodes

There are two possible ecg configurations.

standard configuration

1. Shave the skin on the underside of the subject in five different areas as follows:
 - two circles of 5 cm diameter below the left front leg and the right front leg (LA and RA electrodes)
 - two circles of 5 cm diameter mid-way between the front and rear legs, on the left side and the right side (LL and RL electrodes)
 - one circle of 5 cm diameter 7 cm below the front left electrode (V electrode), i.e. under the heart
2. Wipe each area with gauze sponge and alcohol and allow to air dry.
3. Connect the electrodes to the wires of the ecg cable.
4. Place the adhesive electrodes on the bare skin, at the correct site (figure 8). Press around the edge of the electrode but not in the centre.

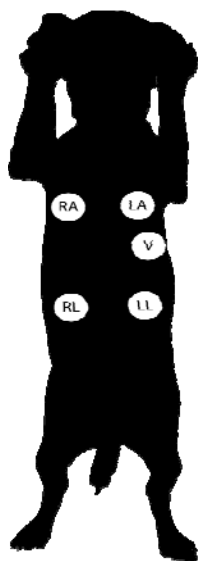


figure 8 **standard placement of electrodes**

alternative configuration

Experience has shown that this configuration can also provide high-quality ecg signals, notably in beagles. The placement of electrodes for 6-lead ecg (shown in figure 9, AAMI colours) is adapted to the position of the heart (more central within the chest cavity), with the current flows crossing in the subject's chest (figure 10). All the electrodes should be aligned along an imaginary circle drawn around the subject's chest and be located away from its normal range of movement.

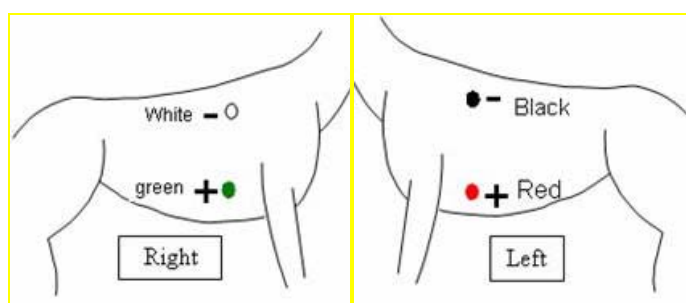


figure 9 **electrode placement in alternative ecg configuration**

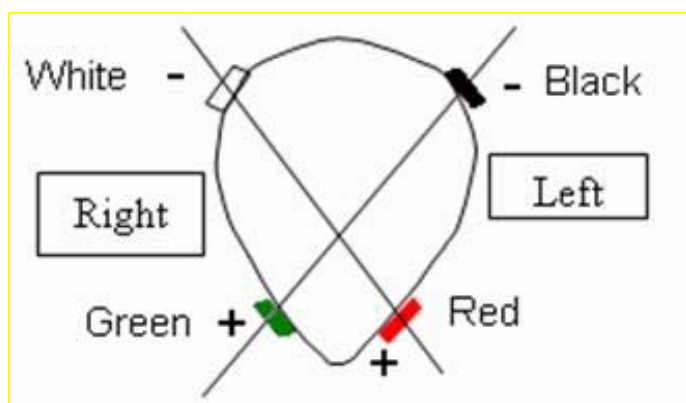


figure 10 **current flows in the alternative ecg configuration**

subject preparation - dress the subject

5. Secure the wires in position with the undershirt. As an alternative or if the undershirt is not sufficient, use white tape and bandaging (figure 11). The bandaging must not be too tight as this will impair the animal's breathing.



figure 11 placing bandaging around electrodes and wires

6. Place the jacket around the subject.
7. Place the **emkaPACK** transmitter in the jacket pocket.
8. Ensure that there are no loose wires hanging out, as these are liable to be chewed or to catch on objects. The subject is ready (figure 12).



figure 12 emkaPACK transmitter in place

The procedure is the same for other ecg configurations (such as 6-lead ecg) with steps 1 to 4 modified accordingly. figure 13 shows electrode placement for obtaining 1-lead ecg (for lead II).



important! all the wires of the ecg cable must be connected to the subject, even if you are not using them (for example, if you wish to acquire 1-lead ecg with a 5-wire cable). Otherwise, the signal will be inaccurate. ecg cable can be ordered from **emka** TECHNOLOGIES.



figure 13 example placement of electrodes for 1 lead ecg (lead II)



note: the **emka**PACK transmitter can be used to obtain ecg data from other large animals, such as primates and pigs.

power up

Plug the ecg cable into the **ecg**LEADS connector to turn on the **emka**PACK transmitter. It then performs a boot procedure. During this procedure, which only takes a few seconds, the led goes from off to solid green (i.e. not flashing). After successful boot-up, the led simply goes off.

If the LED does not go on or goes solid red, there is a potential problem with the **emka**PACK transmitter. If this happens, switch off the **emka**PACK transmitter (by disconnecting the ecg cable), check the connections and batteries, then switch it on again. If the problem persists, please contact **emka** TECHNOLOGIES (see 'Technical support' chapter).

recording session

No particular action is required during recording sessions.

If the battery charge falls below a certain level, the 'low battery' led lights up on the corresponding receiver module.

4.1.3 after sessions

At the end of the experiment, disconnect the ecg cable from the **emka**PACK transmitter to switch off the power.

The **emka**PACK transmitter should be stored in a cool dry place. Keep it away from sunlight and other sources of heat. Keep it away from sources of magnetism.

If you will not be using the **emka**PACK transmitter for some time, remove the batteries.

chapter 5 maintenance

For accurate data, the calibration of the telemetry system must be verified on a regular basis. At installation, **emka** TECHNOLOGIES provides a calibration certificate valid for one year. Certificate renewal (verification or recalibration) is performed as part of maintenance contracts.

Calibration should be performed as often as necessary. In practice, the frequency of calibration is imposed by internal regulations or is indicated in certain situations, e.g. exposure to highly variable temperature, humidity, shock etc.

Check the cables and connectors regularly.

If you will not be using the **emka**PACK transmitter for some time, remove the batteries.

chapter 6 extending functionality

emka TECHNOLOGIES sells a range of modules for the acquisition of different types of signals.

- skin temperature
- blood pressure, non-invasively (nibp module) or in combination with a vascular access port (**t**-PRESS module)
- lung volume (**emka**BELT module)

Please contact **emka** TECHNOLOGIES for more information about using your **emka**PACK with the above modules.

chapter 7 frequently asked questions

7.1 emkaPACK transmitter

can I use the emkaPACK transmitter for eeg measurements?

Each type of bioelectric potential has a characteristic amplitude, frequency, signal-noise ratio, etc and requires specially designed components. Currently, **emkaPACK** telemetry system is designed to measure ecg only. However please let us know if you are interested in using **emkaPACK** transmitter for measuring other biopotentials. Our aim is to satisfy our customers' requirements.

can I use rechargeable batteries?

Yes, but it is recommended to use single-use batteries to reduce the risk and the duration of recording gaps during experimental sessions. This is because:

- single-use batteries generally provide current for longer than fully-charged rechargeable batteries.
- single-use batteries generally have a more gradual discharge curve. This means that they will reach full discharge 3-4 hours after the 'low-battery' warning appears (versus 10-15 minutes with most rechargeable batteries).

Please check the website www.emka.fr (in English) to see the latest options. If you cannot find the product you need for your experiments, please contact us.

is there a help-line?

The answers to most technical issues are contained within this user manual, in particular, the 'troubleshooting' and 'frequently asked questions' chapters.

If you cannot find a solution in this manual, you may:

- check the website at www.emka.fr (in English)
 - products >> software
 - applications >> telemetry
 - services >> technical support
 - services >> FAQs
- contact **emka** TECHNOLOGIES (see 'technical support' chapter)
- fax back the Support Form in the 'customer feedback' chapter

7.2 ecg

how often do I have to calibrate the ecg module?

Generally, we recommend that users perform calibration with a device that simulates ecg signals (e.g. ecg calibrator from **emka** TECHNOLOGIES) at least once a month. More frequent calibration may be imposed by internal regulations or indicated in certain situations, e.g. if the **emkaPACK** transmitter is subject to highly variable environmental conditions (temperature, humidity, shock etc).

what type of ecg data can I acquire using the emkaPACK transmitter?

As part of a telemetry set-up, **emkaPACK** transmitter may be used for acquiring

- 1-lead ecg
- 6-lead ecg (3 Einthoven bipolar, 3 Goldberger unipolar)
- 7 lead ecg (3 Einthoven bipolar, 3 Goldberger unipolar, 1 unipolar chest lead)

is it possible to change ecg configuration, e.g. from 6-lead ecg to 7-lead ecg ?

Yes, it is possible to change ecg configuration. However, the system must be adapted by using appropriate cable and reconfiguring **emkaPACK** transmitter internal software (this is done by **emka TECHNOLOGIES**).

Correct cable and reconfiguration are particularly important if you decide to 'down-grade' ecg configuration (e.g. 7-lead to 6-lead, or 6-lead to 1-lead). If the appropriate cable is not used, unused electrodes may cause interference. To ensure accurate signals, every wire of the ecg cable must be connected to the subject, regardless of whether its signal will be acquired.

can I make eeg measurements using emkaPACK transmitter?

Currently this is not possible. However please let us know if you are interested in using **emkaPACK** transmitter for this purpose. Our aim is to satisfy our customers' requirements.

7.3 activity

how often do I have to calibrate the activity option?

The activity option is factory calibrated; the accelerometer is designed to provide the same voltage output for a given activity level over time.

You only need to enter pairs of calibration values (voltage and physical quantity) directly into your data acquisition software. This 'manual calibration' therefore is not a full calibration because you type in the quantity rather than physically apply it.

chapter 8 troubleshooting

the LED does not go on when the ecg connector/power plug is connected

Possible causes and solutions:

One or both batteries are the wrong way.

→ Place the batteries the right way.

One or both batteries has run out.

→ Insert new batteries.

emkaPACK transmitter is defective.

→ Contact technical support (See 'technical support' chapter)

the LED is solid red

Possible causes and solutions:

Initialization has failed.

→ Check all connections.

emkaPACK transmitter is defective.

→ Contact Technical support (See 'technical support' chapter)

there are no signals from one of the emkaPACK transmitters (the 'source on' led of the corresponding receiver module is off)

→ Ensure that the antenna networks (the VAAs) are powered up

→ Check that the corresponding **emkaPACK** transmitter is working.

- are the batteries the right way?

- have the batteries run out?

→ Insufficient transmission range

Under normal conditions, the settings of each **emkaPACK** transmitter should ensure continuous coverage, wherever the subject is located

there are no signals from any of the emkaPACK transmitters

Possible causes and solutions:

There is no power supply in the receiver mainframe:

→ Check the power supply module in the receiver mainframe (the led should be green): Has the fuse blown? Is the power switched on?

there is no physiological signal

→ Check the connections.

→ Check that the electrodes connectors have not become disconnected.

the ecg signal is noisy

→ Check that all wires are connected to the electrodes.

→ Check that the electrodes are properly stuck to the subject

chapter 9 recommendations

emka TECHNOLOGIES strongly recommends the use of DURACELL PROCELL AA/LR6 2700 mAh alkaline batteries.

After extensive testing, we found DURACELL PROCELL batteries to be reliable as well as powerful enough to run **emka**PACK for 80 hours when transmitting information for 7-lead ecg and activity. These batteries are reasonably priced (around EUR 0.35 or US\$ 0.50 each).

Other batteries exist, some of which have a higher energy capacity. For example, the ENERGIZER ULTIMATE LITHIUM battery has close to twice the energy of a DURACELL PROCELL. Although their cost is disproportionately higher, some customers may find them attractive because of their high energy content. However, **we strongly recommend against the use of high-power batteries to run emkaPACK transmitters**; this recommendation is based on the following facts:

- **emka**PACK is powered by two 1.5V batteries running in series, providing a total of 3V.
- **emka**PACK is fitted with an electronics module that provides its key components a stable 3V power supply even when available battery voltage drops below the nominal 3V value (as occurs towards the end of battery life).
- **emka**PACK does not have an equivalent feature that stabilizes voltage at 3V when batteries provide a total voltage above 3V.
- high-power batteries usually provide voltage well above 1.5V (typically up to 1.8V), and their voltage remains above 1.5V through most of their life span.
- running **emka**PACK with voltage above its nominal 3V has undesirable effects on the amplitude of the transmitted signal. For example, going from a voltage of 3V to 3.6V causes a decrease of around 15% in the output amplitude of ecg or activity.

To avoid difficulties and inconsistencies between calibration and measurements, all customers are advised to use alkaline DURACELL PROCELL or equivalent batteries.

These recommendations should not present a problem for the majority of our customers. However, if you believe that the recommended batteries will not have sufficient power, please contact **emka TECHNOLOGIES SA (France)** for advice on how to proceed and/or to find a solution.

Future versions of **emka**PACK transmitters will be designed to accept high-power batteries without any undesirable effects on signal amplitude.

chapter 10 technical specifications

| parameter | description | value | | | unit | notes |
|------------------------|---|-------|-------------------|-----|-------------------|--|
| | | min | typ | max | | |
| Vcc | supply voltage | 1.1 | 3 | 3.3 | V | DC |
| Icc | supply current | 8 | 13 | 30 | mA | Depends on factory settings. See calibration certificate |
| Trd | transmission distance | 0.75 | | 10 | m | Depends on factory settings and environment |
| Lbt | low battery indication | 1.7 | 1.8 | 1.9 | V | See calibration certificate |
| Fa | functional autonomy | 48 | 72 | 80 | Hours | Depends on transmission power and battery type |
| Tst | storage temperature | -10 | 20 | 60 | °C | |
| Top | operating temperature | 10 | 35 | 50 | °C | |
| HRs | storage humidity | 20 | 40 | 80 | %RH | |
| HRO | operating humidity | 30 | 50 | 70 | %RH | |
| Dimensions | length: width: depth: | | 117 78 27 | | mm mm mm | |
| Weight | weight (with batteries) | | 180 | | g | |
| Battery | 2 x AA/LR6 type battery | | 1.5 | | V | Duracell PROCELL 2700 mAh or equivalent alkaline model recommended |
| ecg signal | | | | | | |
| Lo Freq | low cut-off frequency | | 0.7 | | Hz | -3 dB |
| Hi Freq | high cut-off frequency | | 250 | | Hz | -3 dB |
| Max offset | maximum input offset | -75 | 0 | +75 | mV | F < 0.7 Hz |
| Aimax | max. input amplitude | -4 | 1 | +4 | mV | 0.7 < F < 250 Hz |
| Fs | sampling frequency | | 500 | | Hz | |
| Zi | Input impedance of ecg amplifier | | 3.10 ⁹ | | Ω | |
| G | signal amplification | | 1 | | V/mV | see calibration certificate |
| Res | amplitude resolution | | 7.8 | | μV | |
| activity signal | | | | | | |
| Fs | sampling frequency | | 5.1 | | Hz | |
| AMax | Maxim acceleration amplitude per axis (x, y or z) | - 1.5 | | 1.5 | m.s ⁻² | |

table 4 technical specifications

chapter 11 good laboratory practice

As part of its commitment to customer service, **emka** TECHNOLOGIES provides assistance to customers to allow them to conduct studies according to good laboratory practice. Assistance covers validation and maintenance.

11.1 validation

Telemetry systems from **emka** TECHNOLOGIES are developed according to high quality assurance standards and have built-in features which allow them to be successfully validated.

emka TECHNOLOGIES performs a validation of the system's accuracy, stability, and reliability at installation, i.e. for your specific system configuration under your specific operating procedures and your specific operating environment.

As the system provider, we know how the system operates; thus, we can provide efficient validation assistance through our validation support service packages:

- support to customer and/or third-party package
- sample plan and test script models package
- tailored models package
- full validation process package

We provide assistance for the entire validation process.

11.2 maintenance

Our maintenance contracts provide you with assistance for any problems encountered, and yearly controls.

chapter 12 technical support

The answers to most technical issues are contained within this user manual. In particular, the 'troubleshooting' and 'frequently asked questions' chapters contain answers to the most commonly occurring issues.

If you cannot find a solution in this manual, please:

- check the website
- contact **emka** TECHNOLOGIES
- fax back the 'support form' in the 'customer feedback' chapter

12.1 internet site



The website of **emka** TECHNOLOGIES at www.emka.fr contains a lot of information, including technical support and services. We invite you to visit the following sections:

- products >> hardware >> non-invasive telemetry
- applications >> telemetry
- services >> technical support
- services >> faq

12.2 your **emka** TECHNOLOGIES contacts

If you searched www.emka.fr and could not find the answers you need, contact your local office or **emka** TECHNOLOGIES corporate headquarters.

emka TECHNOLOGIES corporate headquarters

emka TECHNOLOGIES SA

59, bd. Général Martial Valin 75015 Paris - France

phone: + 33 (0)1 40 60 76 00

fax: +33 (0)1 40 60 65 55

sales and support office for North America

emka TECHNOLOGIES INC.

115 Hillwood Ave., Suite 203 Falls Church, VA 22046 - USA

phone: +1 (703) 237-9001

fax: +1 (703) 237-9006

chapter 13 customer feedback

13.1 support form

Photocopy this page and fill it out each time you encounter problems. Completing this form accurately helps us to answer your question more effectively.

personal information:

name:

title/function:

company:

address:

fax/phone (please indicate which):

Describe the problem below.

Please return the form by post or fax

emka TECHNOLOGIES (corporate headquarters)

59, bd. Général Martial Valin 75015 Paris - France / Fax: +33 (0)1 40 60 65 55

emka TECHNOLOGIES INC (sales and support office for North America)

115 Hillwood Ave., Suite 203 Falls Church, VA 22046 - USA

Fax: +1 (703) 237-9006

13.2 feedback on this user manual

emka TECHNOLOGIES strongly encourages feedback on its products and services. Please let us know what you think about this user manual by returning the form below. This information will enable us to continue to improve our documentation.

My feedback concerns:

emkaPACK transmitter user manual version 1.4 rev.1 – August 2008

personal information:

name:

title/function:

company:

address:

fax/phone (please indicate which):

Please tell us whether you think that this manual is (circle the correct answer)

- | | |
|-----------------------------|----------|
| • exhaustive | Yes / No |
| • clear, easy to understand | Yes / No |
| • well organized | Yes / No |
| • useful | Yes / No |

If you have specific comments or suggestions for improving the manual, please mention them here:

If there are any errors in the user manual, please describe them here (with page number/ section)

Thank you for your time. Your feedback is valuable to us.

Please return the form by post or fax

emka TECHNOLOGIES (corporate headquarters)

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emka TECHNOLOGIES INC (sales and support office for North America)

115 Hillwood Ave., Suite 203 Falls Church, VA 22046 – USA

Fax: +1 (703) 237-9006

13.3 general feedback form

emka TECHNOLOGIES strongly encourages feedback on its products and services.

This form may be used to provide feedback on any of our products and services. This information will enable us to continue to provide quality products to meet your needs.

product or service concerned:

personal information:

name:

title:

company:

address:

fax/phone (please indicate which):

provide your feedback below

Thank you for your time. Your feedback is valuable to us.

Please return the form by post or fax

emka TECHNOLOGIES (corporate headquarters)

59, bd. Général Martial Valin 75015 Paris - France / Fax: +33 (0)1 40 60 65 55

emka TECHNOLOGIES INC (sales and support office for North America)

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End of user manual.

Thank you for purchasing the **emka**PACK transmitter as part of your telemetry setup.

Our goal is to develop products and services that meet the needs of the research community. As such we are attentive to all our customers and your feedback is appreciated.

emka TECHNOLOGIES



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