USER MANUAL

MNPG213-00 Edition 14/01/2016

BIO EMG

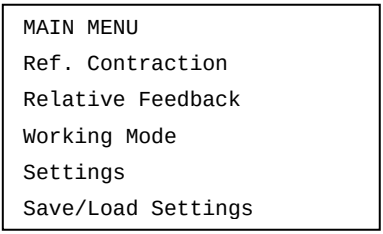
Read the user manual carefully before using the BIO EMG.

CONTENTS

1. GENERAL DESCRIPTION

What is BIO EMG: this is a biofeedback instrument based on the analysis of surface electromyographic signals (sEMG). The device is designed to detect signals generated by muscles in the human body and provide feedback from two channels.

What is BIO EMG used for: the user can record the MVC (maximal voluntary contraction) generated by a muscle. Subsequently, by setting the MVC values in percentage, the patient can do exercises under total control of the force expressed. There are two Working Modes: UNDER THRESHOLD and MAINTAIN TARGET.



Reference Contraction Mode (MVC)

Measures the maximum voluntary contraction (MVC) representing the reference value required to set the Target or under Threshold working mode. In this mode, the assistant/therapist can detect the force expressed by a muscle/muscle group in the same patient at different times. In this way you can get an indication on the trend of the force expressed at different times. Another application involves the measurement before and after a session of osteopathy to evaluate the effects. In any case, these are NOT diagnostic measurements, but only indicative of a trend.

According to the different targets set by the assistant or the therapist, the following two modes can be used: UNDER THRESHOLD and MAINTAIN TARGET.

When to use the Under Threshold mode

This mode should be used when you intend to perform contractions/exercises below a certain threshold referred to the MVC value previously measured. For example, when you want the patient to contract a certain muscle without overworking the same, for a set number of times. Or, when you want to monitor the activation of a muscle during work or sports activities: for

example, you want muscle activation to be maintained below a certain threshold (the patient is alerted each time the threshold is exceeded, being aware of this and focusing on muscle relaxation). See how to use the *Under threshold* working mode on page 17.

When to use the Maintain Target mode

This mode guides the patient to perform contractions until reaching a **Target** which must be maintained for a variable period of time (2-5 seconds). This mode promotes the recovery of force but most of all patient gesture control. In particular, by reducing the **Target Error** you will have an increase in difficulty of the exercise and, therefore, an increase in the control ability of the patient. See how to use the *Maintain target* mode on page 16.

MAIN APPLICATIONS

- **Neurological rehabilitation** (provides the patient and the therapist quantitative and qualitative indication on the muscles monitored). In this way, it provides a quantitative support that helps the patient activate individual muscles when his/her control ability is limited.
- **Functional rehabilitation:** it helps the patient and the therapist to qualitatively measure the degree of muscle activation, particularly when used in TARGET mode. The aim is to bring awareness about the activation of a certain muscle or action to be taken, providing control over the execution of the gesture.
- **Quantitative measurement.** Provides clear indications about muscle activation degree. For example before and after an osteopathic manoeuvre, to measure the force of agonist or antagonist muscles next to the treated area. It can also be used in case of muscle hyper-activation to offer the patient the possibility to control hyper-activations.

The biofeedback is both visual (display) and acoustic (internal buzzer).

Bioelectric signals are measured in single differential mode with bipolar electrodes. These signals are amplified, filtered, converted to digital signals and then shown on the display (stored in the internal memory, if installed).

2. CONTENTS OF BIO EMG KIT

- 1 BIO EMG amplifier (device).
- 1 cable for connecting the reception and earth electrodes.
- 1 USB charging cable.
- 1 110/240V battery charger with USB plug
- 4 earth electrodes.
- 6 concentric electrodes for signal reception.
- 1 user manual BIO EMG.

3. INTENDED USE

The BIO EMG system allows non-invasive recording of surface electromyographic signals (sEMG) received by electrodes placed on the skin. The device is suitable for training and recovery of muscles after injury; it is useful for quantitative and qualitative definition of muscular activity. To use the BIO EMG device properly you must read the user manual.

Contraindications

BIO EMG is a battery powered device and has no particular contraindications.

Side effects

No significant side effects known. All parts that come into contact with the patient are made of biocompatible materials. Slight allergic skin reactions (such as rash) may appear; such reactions are minimised due to short duration of electromyographic signal acquisitions. No form of energy is transferred to the human body! The device is only meant to capture electrical signals from the muscles. The device has no diagnostic purposes. It is only intended to monitor physical exercise by assessing the degree of muscle activation and comparing the degree of muscle activation at different times.

4. WARNINGS

The use of BIO EMG is forbidden under the following conditions:

- While using surgical equipment, shortwave and microwave.
- In mentally impaired patients, unless assisted by a professional rehabilitation therapist.
- Whenever the equipment is damaged.
- In the vicinity of flammable substances (especially flammable liquids and gases) or in environments with high concentrations of oxygen.
- In patients who use "life-saving" devices that may be adversely affected such as pacemakers or others, unless assisted by a professional rehabilitation therapist.

Please observe the following precautions:

- Use exclusively the electrodes supplied by the manufacturer: BIO EMG is guaranteed to output the rated performance only if used with the electrodes supplied by the manufacturer.
- Immediately contact the manufacturer if foreign materials get inside the device (liquid, powder, etc.). Should BIO EMG be subjected to impacts (like a fall to the ground, etc.), make sure that any crack or any other type of damage of the casing has damaged the device. Should you have any doubts, please contact the manufacturer.

- Incorrect measurement may be encountered if the device is being used in the presence of electromagnetic sources (for example strong electromagnetic fields). The presence of interference within the signals can be easily observed by qualified personnel. For this reason we recommend you always use the device in "clear" environments, free from electromagnetic disturbances, away from power supplies, power outlets, and other electronic devices that may interfere with sEMG signal reading.
- The use of BIO EMG is allowed to persons properly trained on how to use the same by reading the user manual.

5. MEANING OF THE SYMBOLS ON THE BIO EMG AND IN THE USER MANUAL

The four front keys allow the user to completely control the device and all its functions. The keys of the instrument allow the user to access and exit the various submenus, edit parameters, start and stop the acquisition process.

Each time you press a key, the instrument emits a beep indicating that the keystroke was recognised.

The "arrow up" and "arrow down" buttons allow the user to select the items of the menus or increase or decrease the value of a parameter when the latter is being edited.

The "OK" button, depending on the state of the device, allows you to enter the selected menu, edit the value of a parameter, and confirm the new value entered.

The "ESC" button, depending on the state of the device, allows you to exit the menu selected and exit the parameter editing window.

Multifunction keys, selection of menu options, selection of parameters and setting of desired values.

Multifunction key that allows you to confirm the selected parameter and open the parameter setting window.

Multifunction key that allows you to exit the menu, and the parameter setting window.

SWITCHING ON THE EMG BIO

6. MENU STRUCTURE

TABLE 7.1 provides a summary description of BIO EMG system menu.

Mode		Description
Reference Contraction		When selected with the OK button, it records the reference contraction level, the MVC (maximum voluntary contraction). Subsequent measurements will take this value as a reference for the working mode. Once you have made the acquisition, press ESC to return to the main menu.
Relative Feedback		After detecting the MVC, in the previous step, this function activates the audible and visual feedback. It will be a percentage of MVC. The therapist may ask the patient to perform all contractions at 50% of the MVC.
Working Mode	**Under Threshold**	This mode ensures that a certain threshold for each individual contraction is not exceeded (i.e. 65% of the MVC).
	Target	This mode provides maintaining a level of contraction as a percentage of MVC. For example, 40% of the MVC with a margin of error (target error) that can be set in the SETTINGS mode. The higher the margin the easier the exercise, the lower the margin the higher the difficulty.
Settings	**Channel Settings**	It allows you to enable or disable the channels (CH1 only, CH2 only, both), set the display scale (GAIN), and the alarm threshold for the Under Threshold working mode.
	Edit Target	Allows you to set the level of contraction to maintain in TARGET mode
	Target Error	Allows you to change the tolerance of the level of contraction set in TARGET mode.
Save/load Settings		Saves the current settings or loads a previously saved set of settings. The device can store up to 4 programs.

TAB. 7.1 Summary of settings of the pages displayed by BIO EMG

FIG. 7.1 to the right shows the page displayed if you select the recording mode of maximum voluntary contraction (MVC).

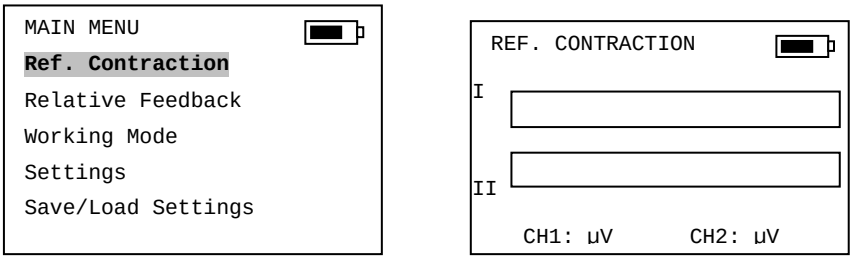


FIG. 7.1: Reference Contraction Function

FIG. 7.2 to the right shows the two pages displayed depending on whether you select Relative Feedback Under Threshold (A) mode rather than the Maintain Target (B) mode.

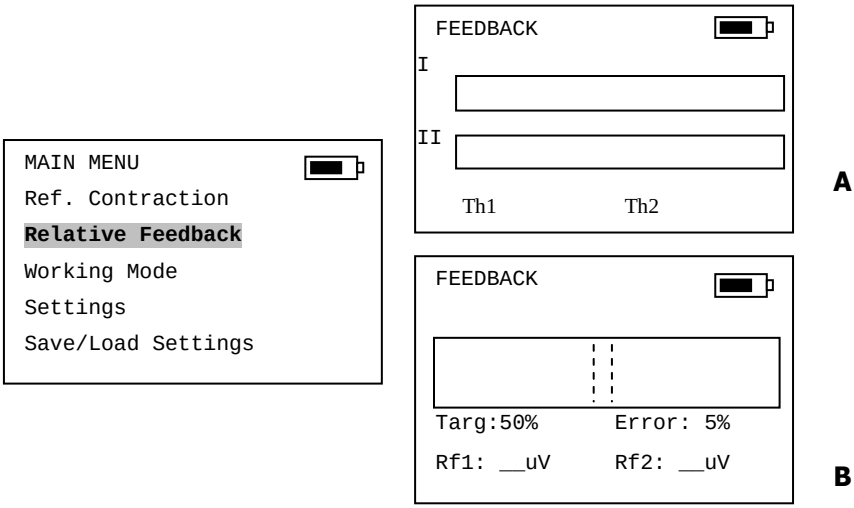


FIG. 7.2: Relative Feedback function page: Under Threshold (A), Maintain Target (B).

FIG. 7.3 to the right shows the pages displayed when you enter the Working Mode selection mode.

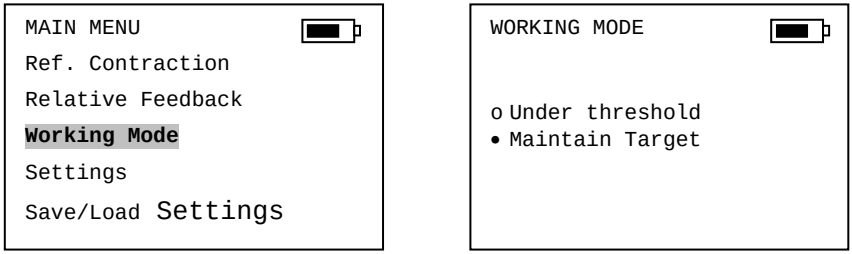


FIG. 7.3: Working Mode operating mode page

FIG. 7.4 shows the Settings function pages. FIG. 7.5 to the right shows the page displayed when you enter the Target setting mode. FIG7.6 shows the Target Error setup page. FIG. 7.7 to the right shows the channel setup page.

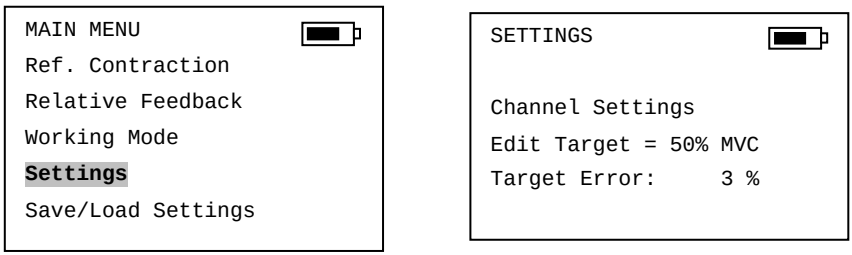


FIG. 7.4: Settings function pages

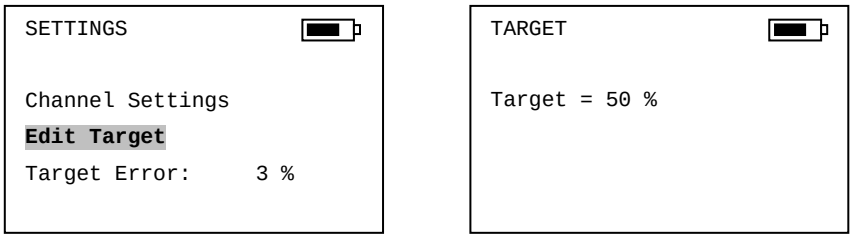


FIG. 7.5: Edit Target function page

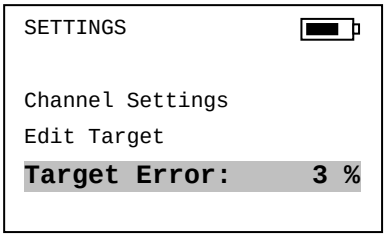


FIG. 7.6: Target Error function page

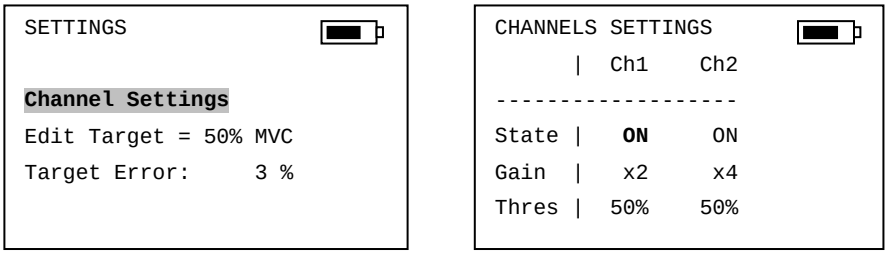


FIG. 7.7: Channel Settings function page

SETTINGS

From this menu you can change the settings of the instrument. In particular, the items available in the menu are listed below.

Channels Settings

This function allows you to change the settings of each channel. Use the "arrow keys" to select the desired parameter, then press the OK button to vary the parameter. In particular, for every channel you can change the status (ON or OFF), you can vary the display gain (x 1, x 2, x 4, x 8) and you can also vary the threshold for the Under Threshold mode, gradually by 2% .

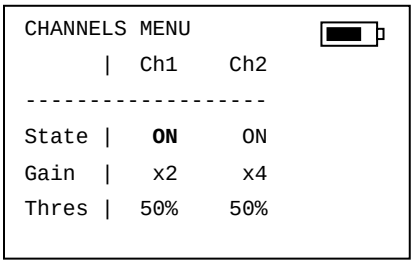


FIG. 9.6: Page for selecting the display scale Firmware Gain Settings.

Edit Target

This parameter is used to adjust the offset from maximum and minimum threshold set by the BIO EMG system for the Relative Feedback → Maintain Target mode. The target value can be set from 0 to 98%, gradually by 2%. The "arrow up" and "arrow down" buttons are used to change the value of the target offset. The "OK" button allows you to save the new value and return to the previous page automatically, while the "ESC" button allows you to return to the previous page without saving the value set.

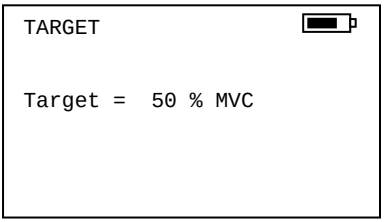
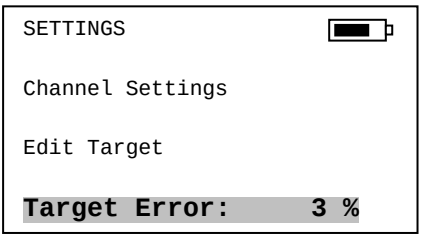


FIG. 9.5: Example of LCD display visualisation during the Edit Target function.

Target Error

This value determines the accuracy, as a percentage, at which the level of contraction set must be maintained. Selectable values range from 1 to 9%: 1% maximum control of the patient, 9% at the beginning of a period of recovery/rehabilitation.



Save/Load Settings

This feature allows you to save or load previously saved or set parameters.

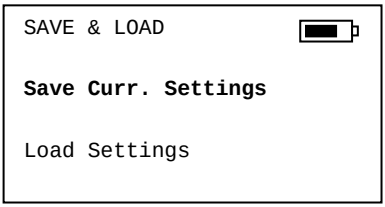
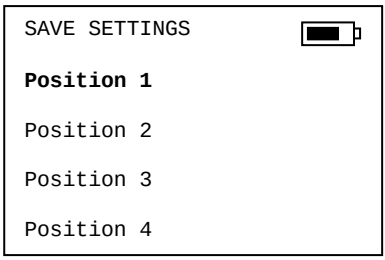


FIG. 9.9: Page for choosing whether to save or load previously saved or set parameters.



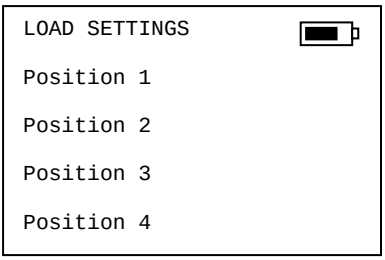


FIG. 9.10: Page with details on saving and loading of parameters previously set or saved.

7. HOW DOES BIO EMG WORK

Use in TARGET mode

1. Connect the cable to the device that will turn on
2. Connect the button electrode near a muscle being monitored
3. Connect the electrode sEMG of CH1 (the one with the black ring) above the middle of the affected muscle. If you need to monitor 2 muscles, use both channels

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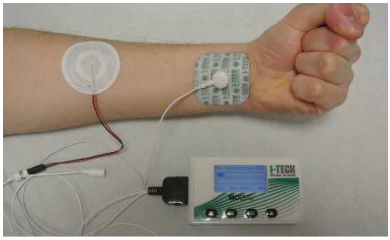
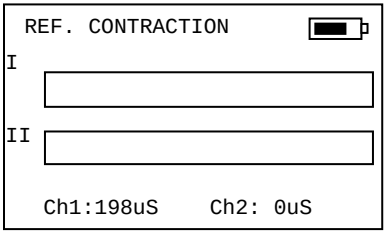
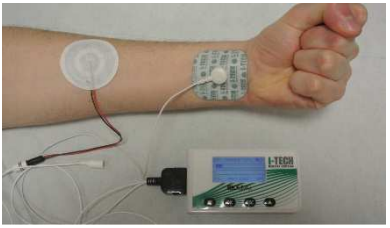
MAIN MENU

Ref. Contraction
Relative Feedback
Working Mode
Settings
Save/Load Settings
```

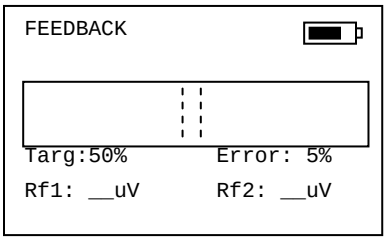


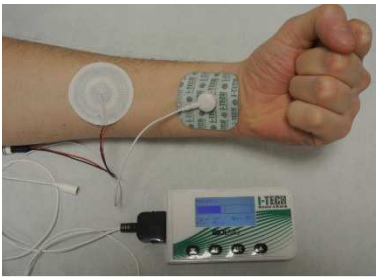
4. Select Working Mode and press OK
5. Select MaintainTarget and press OK, then ESC
6. Select SETTINGS and press OK
7. Select Edit Target and press OK, set the desired MVC value in % using the up and down arrows, then press OK
8. Select Target Error and then press OK. Use the arrows ⓥ and ⓐ to set the desired % of error and confirm with OK. The smaller the value, the more difficult for the user to achieve the Target
9. Select Channel Settings and press OK. Use the arrow keys ⓥ and ⓐ to select the active channels. If you intend to activate both channels, the latter should be all ON. If you want to activate CH1 only, put CH2 to OFF. Then press ESC 2 times
10. Select Ref. Contraction and press OK and perform the MVC test for the connected muscle or muscles. The figure below provides indicative values.





11. Then ESC
12. Select Relative Feedback and press OK. The device starts working. Patient's goal is to achieve the target and maintain the contraction within the range indicated by the hatched bars. At the end press ESC to return to the main menu





13. You can store the previous settings in Save/Load Settings → Save Current Settings → choose one of Pos 1 – Pos 4 and save the desired position with OK. Then ESC 2 times to return to the main menu.

Using the device in UNDER THRESHOLD mode

1. Connect the cable to the device that will turn on
2. Connect the button electrode near a muscle being monitored
3. Connect the electrode sEMG of CH1 (the one with the black ring) above the middle of the affected muscle. If you need to monitor 2 muscles, use both channels

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MAIN MENU
Ref. Contraction
Relative Feedback
Working Mode
Settings
Save/Load Settings
```
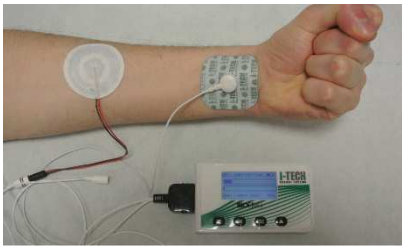
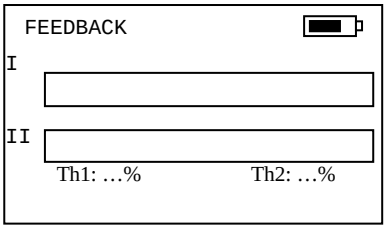
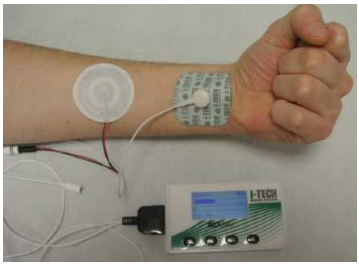



4. Select Working Mode and press OK
5. Select Under Threshold and press OK, then ESC
6. Select SETTINGS and press OK
7. Select Channels Settings and press OK.
8. Use the arrow ⓥ to set the % threshold value (Thres) for CH1. Then press OK to change the desired MVC value in %. Then use the arrow ⓥ to select Thres of CH2 and repeat the operation. Then ESC 2 times.
9. Select Ref. Contraction and press OK and perform the MVC test for the connected muscle or muscles. Then ESC
10. Select Relative Feedback and press OK. The device starts working. At the end press ESC to return to the main menu





11. You can store the previous settings in Save/Load Settings → Save Current Settings → choose one of Pos 1 – Pos 4 and save the desired position with OK. Then ESC 2 times to return to the main menu.

8. MUSCLES TO BE MONITORED – POSITION OF ELECTRODES

The position of the electrodes that capture the EMG signal depends on the muscle or muscles that you want to monitor.

The general rule to follow is to position the reception bipolar electrode above the middle of the affected muscle.

Place the return electrode, with the button attachment, just a little further, possibly near a bony area.

If you are using two reception electrodes, is enough a single return electrode with button attachment to place next to one or two reception electrodes.

9. CHARGING THE BATTERY

The battery of BIO EMG can be recharged in two ways:

- using the supplied power adapter and connecting it to the output of BIO EMG: in this case the average charge time is 2 hours.
- Using the USB port on your computer: in this case the charge time is maximum 6 hours.

10. USING THE MOBILE APP

You can use your device with your tablet or smartphone that have Android operating system. Log on to Play Store directly from your mobile device and type *bioemg* in the search bar. The list of EMG I-TECH applications available will be displayed. Once installed and started the app chosen, connect the BIO-EMG to your tablet or smartphone via bluetooth and follow the instructions displayed.

11. MAINTENANCE AND STORAGE OF BIO EMG

BIO EMG must be used under the following environmental conditions:

Temperature:	from 0°C to +40°C
Maximum relative humidity:	75%
Atmospheric pressure:	from 700 hPa to 1060 hPa

BIO EMG should be stored together with all the elements in the kit, carefully placed on a secure surface protected from the situations listed in the warnings section.

BIO EMG should be stored under the following conditions:

Temperature:	from -20°C to +40°C
Maximum relative humidity:	75%
Atmospheric pressure:	from 700 hPa to 1060 hPa

Cleaning: clean the device exclusively with a dry cloth.

BIO EMG may only be repaired by the manufacturer or authorized personnel. Any repairs performed by unauthorised personnel will be considered non-compliant and will void the warranty.

Disposal.

To protect the environment, the equipment and its accessories must be disposed of in accordance with the law, in specific areas or as special waste.

FAQ FREQUENTLY ASKED QUESTIONS

Frequently asked questions:

During Reference Contraction the EMG signal goes beyond the edge of the bar, even with slight muscle contraction:

1. Check the level of GAIN in SETTINGS → Channels Settings → (if the level is set to x4 or x8, reduce it to x 2 or x 1). Retry the test.
2. Check the condition of the electrodes, both the return electrode with button, and the reception round ones. Try running the test with new electrodes.
3. Check the state of the cables. If a cable is damaged, replace it.
4. Charge the device.

12. TECHNICAL FEATURES

Manufacturer:	IACER Srl, Italy	
Model and Type:	BIO EMG	
Classification:	Internally powered equipment	
Functioning:	device suitable for continuous operation	
Container:	plastic	
Power supply:	3.7 V rechargeable Li-on batteries	
Amplifier:	Input	0 ÷ 4.16 mVPP
	Bandwidth:	16 ÷ 402 Hz
	Input noise level:	< 3 μVRMS
	Gain:	794 V/V
	Input impedance:	> 100 GΩ throughout the band
	CMRR:	> 100 dB
	Output range:	0 ÷ 3.3 V
	Sampling frequency:	1024 Hz
Display:	graphic LCD 128 x 64 pixel, backlit	
Controls:	keyboard consisting of 4 mechanical keys	
Dimensions:	150 x 90 x 25 mm	
Weight:	220g (batteries included):	

CE

13. WARRANTY

BIO EMG is covered by 24-month warranty (or 12 months if used in professional areas) on electronic parts. The warranty enters into effect from the date of purchase.

The warranty is void if the device is tampered with or repaired by staff not authorised by the manufacturer or an authorised dealer.

The warranty conditions are described below.

Warranty terms

1. The warranty period is 24 months on electronic parts (12 if purchased with VAT by professional users). To avail of the warranty contact the store from where you purchased the device or directly the manufacturer.
2. The warranty covers exclusively product damage causing a malfunction. The product covered by warranty should have a serial number equal to that indicated on the purchasing document, otherwise the warranty is not valid.
3. The term "warranty" means exclusively the repair or replacement of components or parts of the equipment that show manufacturing or material defects, including the labour.
4. The warranty does not apply to damages caused by negligence or use that does not comply with the instructions provided, damages caused by unauthorised interventions, accidental damage or damages due to buyer's negligence, with particular reference to the external parts.
5. The warranty does not apply to damages caused by non-compliant power sources.
6. The parts subject to wear are not covered by warranty.
7. The warranty does not cover transport costs, that shall be borne by the buyer, depending on the means and time of transport.
8. After 24 months (or 12 months for professional users) the warranty is void. In this case, the service will be performed by charging the replaced parts, labour and transport expenses, according to the applicable price list.

Manufactured and distributed by:

I.A.C.E.R S.r.l.
Sede operativa:
30030 Martellago (VE) - Via. S. Pertini 24/A
Tel +39 041 5401356 - Fax +39 041 5402684

Sede legale:
S. Marco 2757 - 30124 Venezia
Cod. Fisc./P.IVA IT 00185480274
R.E.A. VE N. 120250 - M. VE001767
Cap.Soc. € 110.000,00 i.v.
www.itechmedicaldivision.com - iacer@iacer.it