

**SERVICE MANUAL  
PULSON 100  
PHYACTION Ub  
PHYACTION Ub MF**

**UNCONTROLLED VERSION!**

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## **2. GENERAL INFORMATION**

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This Performa + repair guide will help you to recognize and solve most of the problems.. However, in addition to this manual, an intensive service training is a must. Please contact our service department for more information:

**GymnaUniphy service department**

Pasweg 6a

3740 Bilzen, Belgium

General Fax number service dept: 0032/89.510.561

**Technical questions:**

Tel: 0032/89.510.563

[Service@gymna-uniphy.com](mailto:Service@gymna-uniphy.com)

Bilzen, December 2008

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### **3. Specifications**

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- Frequency 0.95...1.05MHz
- ERA 4.0cm<sup>2</sup> und 1.3cm<sup>2</sup>
- Intensity 0...2.0 W/cm<sup>2</sup> (contin.)
- 0...3.0 W/cm<sup>2</sup> (pulsed)
- Pulsed Mode
- Pulse frequency 100 Hz
- Duty cycle 10%, 20%, 30%, 40%, 50%
- Treatment time 1...30 min
- Mains voltage 100...240VAC, 50/60Hz
- MDD-Class IIb
- Electrical Class I/BF
- Weigth incl. accessories 4,15kg

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#### ***4. Yearly checkup procedure***

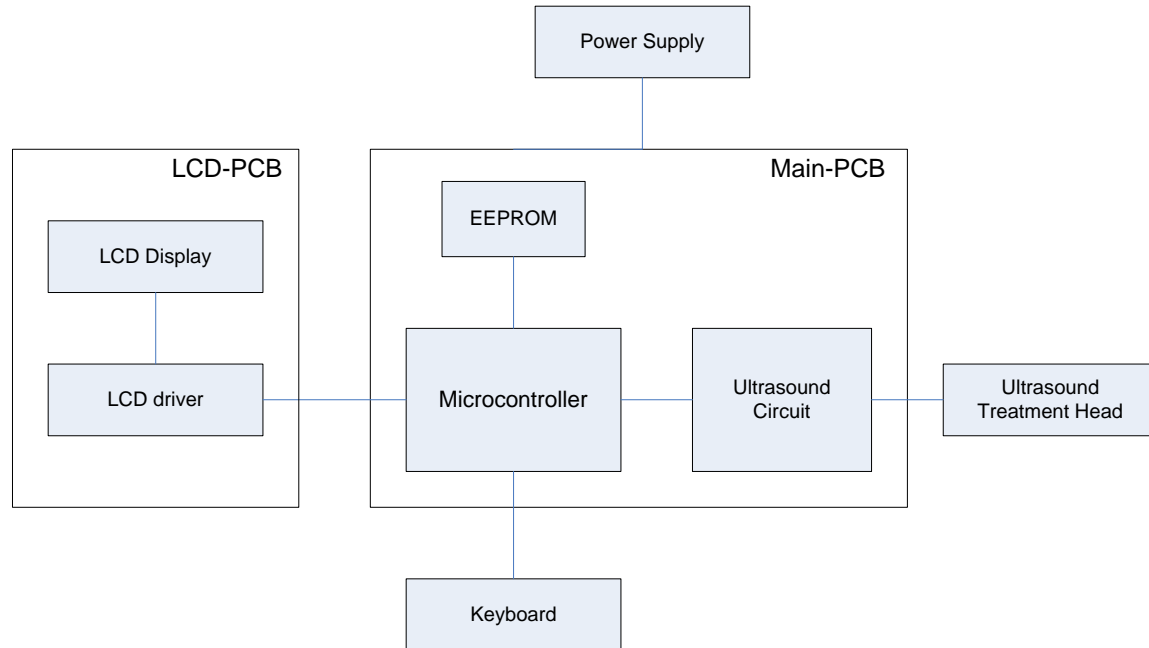
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## 5. CIRCUIT DESCRIPTION

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### 5.1 General block diagram



The centre of the main board is the micro controller core controlling the entire device. The ultrasonic part consists of the frequency generation, the amplifier and measuring circuits.

### 5.2 $\mu$ C core

The micro controller core mainly exists of a micro controller, E<sup>2</sup>PROM and a peripheral interface. The micro controller which are contained the software is the heart of the system it controls and drives all the other circuits and signals. It also controls the keyboard and the LCD display.

## 5.3 Ultrasound

### 5.3.1 Ultrasound Block diagram

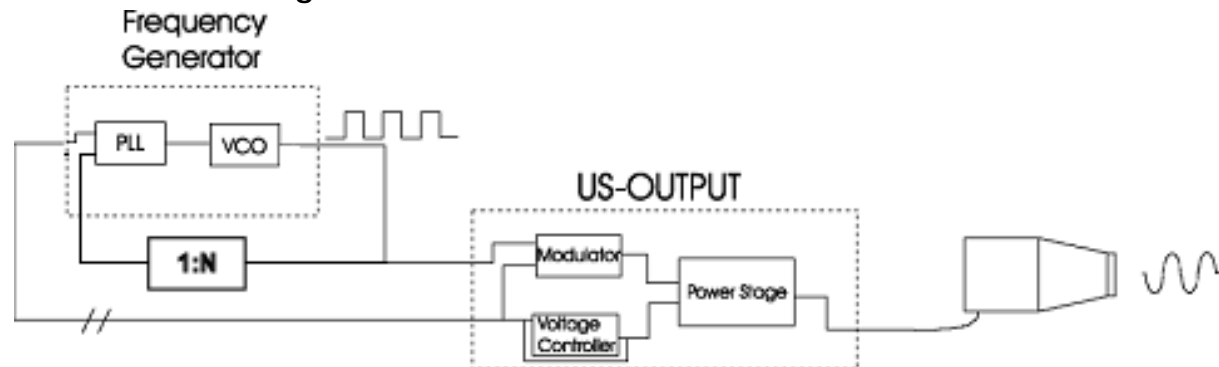


Figure 3-1 Ultrasound Block diagram

### 5.3.2 Theory of operation

#### PLL

The frequency generator is controlled by the micro controller and it contains a voltage controlled oscillator and a PLL (phase locked loop) who generate a stable 1 MHz symmetrical block wave signal.

#### Modulator

The modulator mixes the *pulse* signal with the ultrasound frequency. An amplitude modulation with 100% modulation depth (the signal being switched on and off) is the result of this mixing.

#### Voltage controller

A down voltage converter is used to convert the +24V to the desired ultrasound voltage. The micro controller measures the values of output voltage  $U_{out}$  and output current  $I_{out}$  of the end stage and calculates the output power. Thus the micro controller can adjust the ultrasonic power by setting  $U_{in}$ .

#### Power stage

The power stage is a switched end stage. The power MOSFET is used as switching element. The MOSFET is driven by buffer.

#### Ultrasound treatment head

The ultrasound treatment head is of course a very important part of the apparatus. It converts the electric signal into ultrasound using a piezo crystal. This crystal, with a diameter depending on the desired head size, is glued in an aluminium cup that minimises electromagnetic radiation and enables the crystal to be used on to operating frequency. The ultrasound crystal is mainly a capacitive load. Its impedance differs, among other things, with the size of the crystal and its operating frequency. For this reason in the ultrasound treatment head is integrated a network to convert the impedance of crystal in the optimal load resistance of output stage.



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## ***6. Detailed circuit description for single frequency units***

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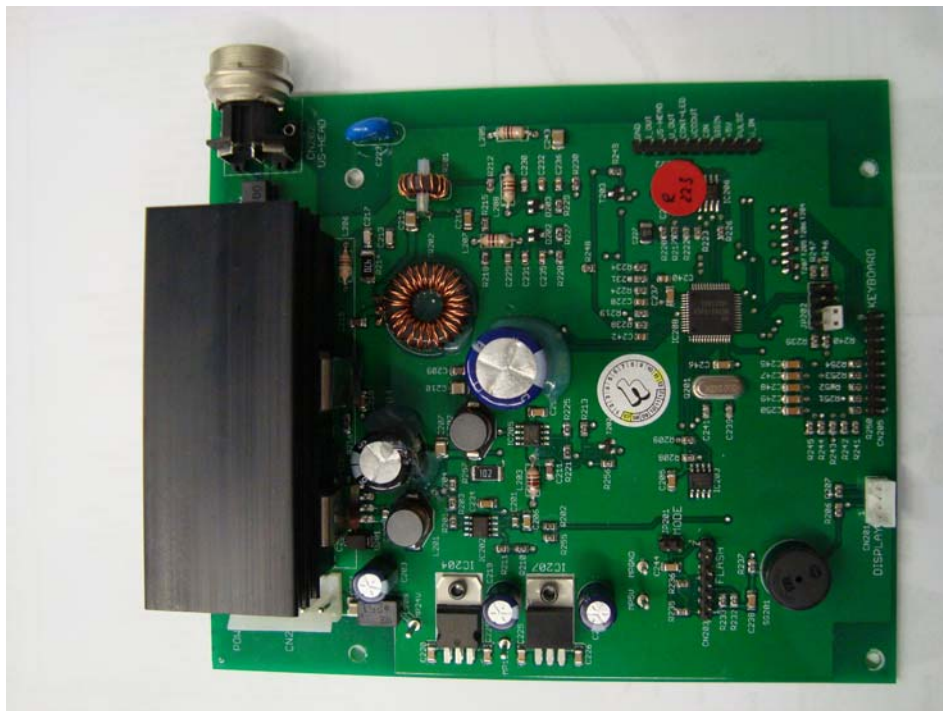


Photo of main PCB for single frequency units

### **6.1 Power supply**

A Switch Mode Power Supply board supplies the PCB with +24V.

IC204 regulates the +24V down to a +15V supply of buffer IC205. IC207 regulates the +15V down to a +5V supply of logic IC's, ultrasound contact LED and Display PCB.

### **6.2 $\mu$ C Core**

IC208 is the micro controller with a Flash Memory that contains the software. The  $\mu$ C has integrated RAM memory, timers and A/D converter.

### **6.3 DISPL. & KEYBOARD INTERFACE**

CN201 is the serial LCD display interface that is connected with driver IC on the Display PCB. SCL is the system clock for synchronisation of the data SDA from and to the device and is controlled by the  $\mu$ C.

The keyboard matrix is connected over CN205.

### **6.4 E<sup>2</sup>PROM**

IC203 is a serial E<sup>2</sup>PROM that stores parameters of ultrasound treatment head. SCL is the system clock for synchronisation of the data SDA from and to the device and is controlled by the  $\mu$ C.

### **6.5 Ultrasound**

### 6.5.1 Frequency Generator

The frequency is generated by IC206 a Phase Locked Loop Frequency Synthesiser with a Voltage Controlled Oscillator (VCO) respectively. The  $\mu\text{C}$  generates a reference frequency of 100Hz on Port P30/TRAO that is connected with CIN input of IC206. The output frequency of the VCO, which is the ultrasonic frequency, will be divided by a timer of the  $\mu\text{C}$ . The value of the divisor depends on the nominal frequency of ultrasound treatment head. The divided frequency arrives at the port P31/TRBO of  $\mu\text{C}$ . This output signal is fed back to SIGIN of IC206 that compares it with a reference. The comparator generates a steering voltage for the VCO control input with the filter R217, R220 and C227. If the phase of the two signals is shifting, which means that the output frequency has changed, the output level of IC206 is altered so that the output frequency of the VCO will be adjusted.

Resistor R222 and capacitor C502 determine the frequency range. R223 enables the VCO to have a frequency offset.

### 6.5.2 Ultrasound Output

The circuit around IC201 is a switch mode DC/DC up converter. Its output voltage is controlled via the feedback voltage connected to pin6.

The  $\mu\text{Controller}$  generates U\_in (Pulse Width Modulation see micro controller schematic) and this is buffered and amplified by the amplifier build up around IC202A. This output voltage of IC202A manipulates together with the feedback voltage of the output the voltage at the FB pin of IC201 and so the voltage over the MOSFET T201 can be regulated.

The US output power is proportional the product of US output voltage and US output current. The resistors R215 and R218 reduce the US voltage. After filtering and rectification the voltage U\_out is measured on  $\mu\text{C}$  port P00/AN7. Transformer TR201 converts the US output current to a proportional voltage I\_out, which is measured on  $\mu\text{C}$  port P01/AN8 after filtering and rectification. The  $\mu\text{C}$  calculates the US output power from both signals U\_out and I\_out.

### 6.5.3 Ultrasound Contact Control

The signals U\_out and I\_out are evaluated also as a check of the US contact. In case of bad US contact

Transistor T203 switches on the US contact LED in the US treatment head over resistor R249 and inductor L205.

### 6.5.4 Ultrasound Head Size Check

As a check, whether a US treatment head and which size of the connected US treatment head has the voltage over R248 evaluated by  $\mu\text{C}$  port P03/AN5. The voltage level certainly by the value of the pre-resistor the US contact LED in the US treatment head (only for single frequency heads)

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## ***7. Detailed circuit description for multi frequency units***

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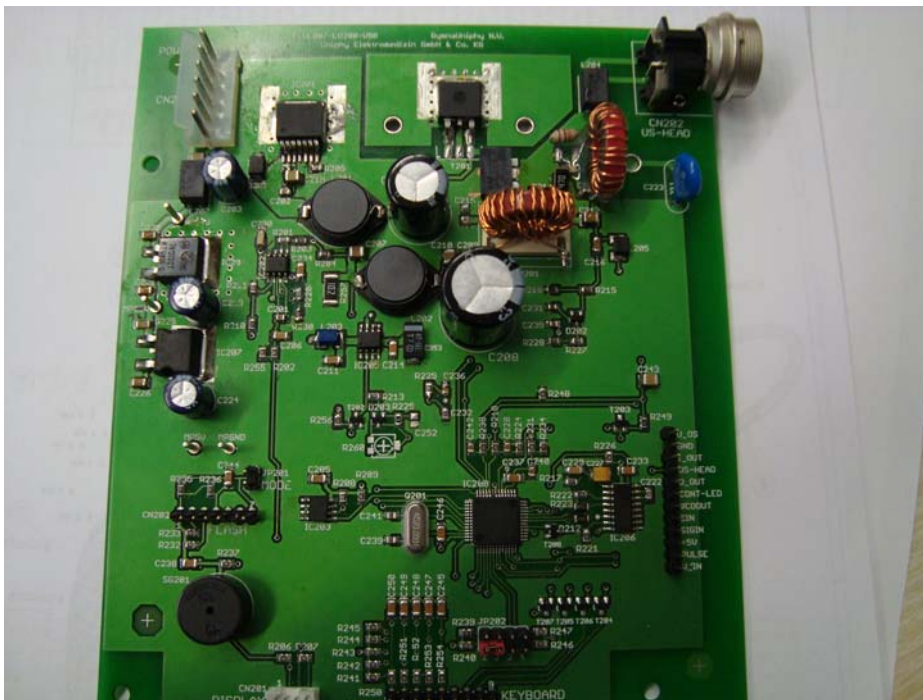


Photo of main PCB for multi frequency units

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## 8. System settings menus

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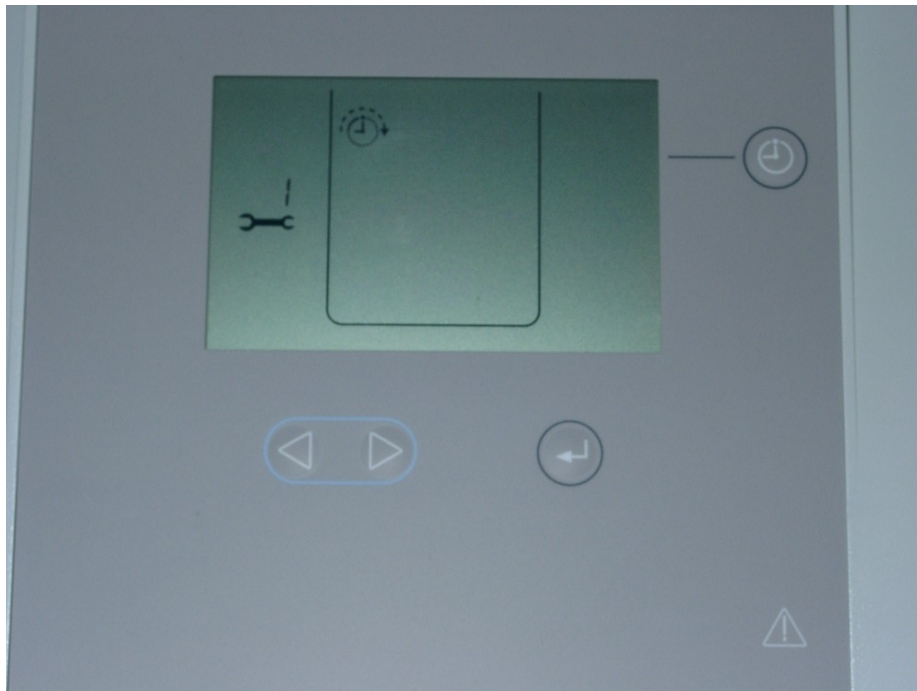
How to enter the system settings menu:

Press the return key for 3 seconds (unit in standby mode)

When the system or service setting menus are active, a 'wrench' appears on the screen together with the program number;

### 8.1 System settings menu 1: stop time if bas US

In case the ultrasound contact is poor (led on head flickers), the timer will stop running until good contact is achieved again.



### 8.2 System settings menu 2: automatic frequency tuning

See chapter 10.3

Display XXXX kHz (US frequency)

It shows the working frequency for the connected head. By pressing the timer key, an automatic calibration of the tuning frequency is performed.

1. Connect the related US head (head must be 100% clean and dry!!) and switch on the unit
2. Press return key for 3 seconds → system program 1 appears
3. Press return key 1 time → system program 2 appears
4. Press timer key → tuning takes 3 minutes from 0% → 100%  
→ This results in a resonance frequency that will be saved automatically.  
→ the tuning procedure can be interrupted by pressing the return key for 3 seconds

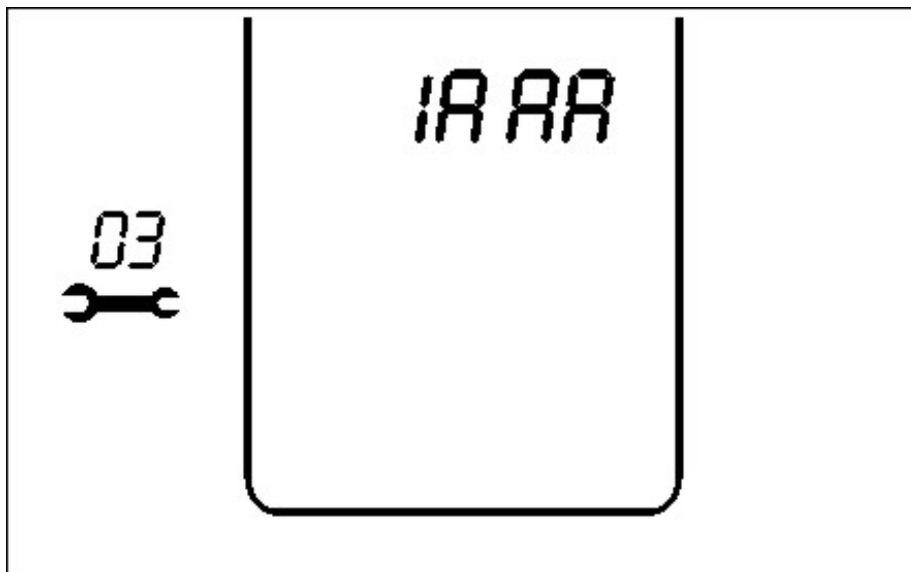
5. Press return key 3 times → system program 5 appears
6. On the cable of the US head there is a label with the power factor (only for single frequency heads). This factor must be copied into the unit in system program 5
7. Exit the calibration module by pressing the return key for 3 seconds.



### 8.3 System settings menu 3: hardware code

Display XXXX (actual hardware code)

Only lookup mode. Can only be edited in the service menu.





#### 8.4 System settings menu 4: software version

Display XXXX (actual software code)

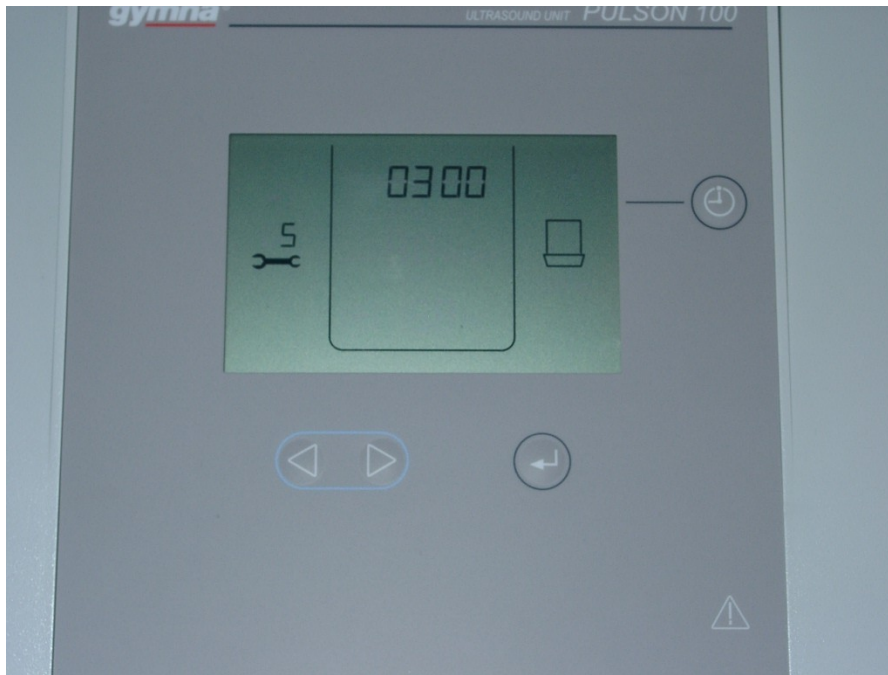
Only lookup mode. Is displayed briefly during startup of the unit.

#### 8.5 System settings menu 5: power factor (Pconst)

See chapter 10.3

Each ultrasound head has a powerfactor that guarantees a calibrated output power (heads are interchangeable).

The powerfactor for single frequency heads is put on a sticker that can be found on the cable of the connected US head.





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## 9. Service menus

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Press and hold during POWER ON the 'UP and 'DOWN' key simultaneous to enter the service menu.

Press 'RETURN' to confirm the value and to enter the next service program number.  
Press 'TIMER' to return to the previous service setting.

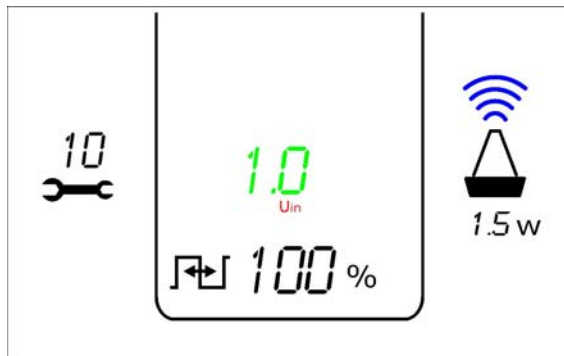
### 9.1 Service settings menu 10 : power adjustment of 1cm<sup>2</sup> us heads

The powerfactor of an ultrasound head is showed on a sticker on the cable of the ultrasound head (only for single frequency heads)

This program can be used to re-calculate the power factor.

**This can only be done by means of a calibrated power meter!**

→ only perform after frequency tuning (prog 2)!

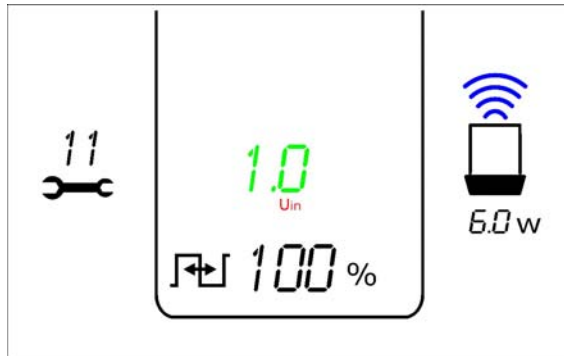


Procedure:

USTH headsize 1cm<sup>2</sup> becomes active if head connected

1. Put head in power meter
2. Step 1: zero point calibration  
Press timer key for 1 second.  
Zero point calibration of amplifier is calculated and displayed automatically (Uin max 0.70). the power meter shows 0 watt.
3. Step 2: 2.2 watt calibration  
Press keys 'UP / DOWN' to change the Uin value → raise until power meter indicates 2.2 Watt.  
Press timer key for 1 second (beep) and the power factor is displayed in upper display and stored in memory (system setting menu 5)  
Press return key: power goes to 0 and program 11 becomes active

### 9.2 Service settings menu 11 : power adjustment of 4cm<sup>2</sup> us heads



Procedure:

USTH headsize 4cm<sup>2</sup> becomes active if head connected

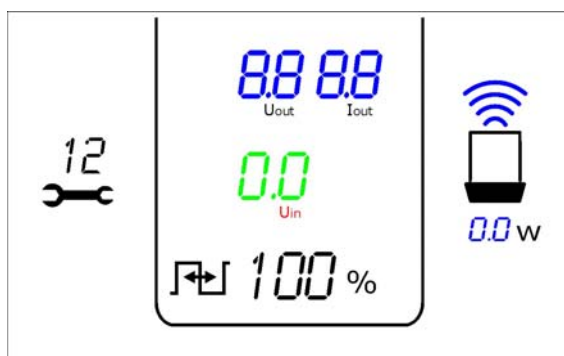
1. Put head in power meter
2. Step 1: zero point calibration  
Press timer key for 1 second.  
Zero point calibration of amplifier is calculated and displayed automatically (U<sub>in</sub> max 0.70). the power meter shows 0 watt.
3. Step 2: 5 watt calibration  
Press keys 'UP / DOWN' to change the U<sub>in</sub> value → raise until power meter indicates 5.0 Watt.  
Press timer key for 1 second (beep) and the power factor is displayed in upper display and stored in memory (system setting menu 5)  
Press return key: power goes to 0 and program 12 becomes active

### 9.3 Service settings menu 12: measurement of output signals (only test function)

Display: U<sub>out</sub> and I<sub>out</sub>

This program, together with program 13, can be used to test the proper functioning of ultrasound heads and to determine whether the unit or the ultrasound head is broken.

In menu 12 the level of U<sub>in</sub> can be set (and a power can be set on the US head). This can further be used to determine the quality of the head in program 13.



Procedure:

USTH headsize 1cm<sup>2</sup>/4cm<sup>2</sup> lights up if head connected  
USTH headsize 1cm<sup>2</sup>/4cm<sup>2</sup> flickers if head not connected

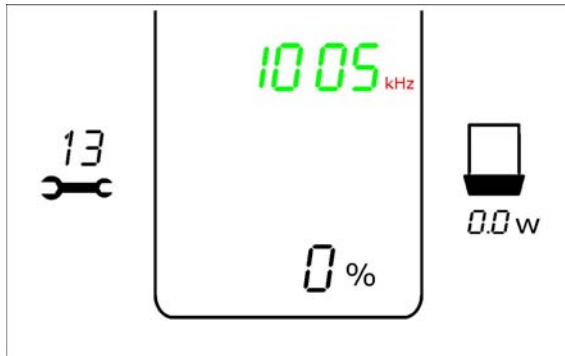
1. Put the head in water and press keys 'UP / DOWN' .  
It is important that Iout value is < 1 in order to protect the US head from overheating (so set it to about 1A)
2. Now Press 'RETURN' to go to pro 13(values cannot be stored)

#### 9.4 Service settings menu 13: measurement of output signals

Display: output frequency and quotient of Uout/Iout  
USTH headsize 1cm<sup>2</sup> / 4cm<sup>2</sup> becomes active if head connected.

In this program, the working frequency of the US head can be changed.  
On the working frequency, the quotient Uout/Iout must its maximum  
Important are the values in water + dry (the difference must be maximum). This can be tested by changing the working frequency and see if there is a better point.

The displayed value cannot be stored and will thus not influence the frequency tuning calibration (system settings menu 2)



Typical values:  
Stored default frequency (kHz) is displayed.  
The relation between U/I become visible  
In water: typical 1 → 2  
Dry: >5 (typical 20 → 30)

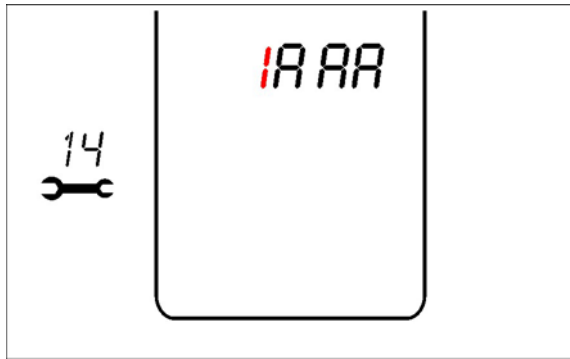
#### 9.5 Service settings menu 14: measurement voltage of output stage

Display: controlling voltage of amplifier (between 0.00V and 20.00V)

#### 9.6 Service settings menu 15: measurement of power supply voltage

Display: 24V volt level  
Ok: between 24.00V and 24.5V (can only be displayed in standby mode)

#### 9.7 Service settings menu 16: Change hardware code



Procedure:

The hardware code consists of 1 figure and 3 letters.

Change the value of the first figure with keys 'UP' or 'DOWN'.

Press 'RETURN' to confirm the value and to select the next letter.

Repeat for the 3 letters.

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## 10. Ultrasound heads

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### 10.1 Different models

#### 10.1.1 Phyaction Ub model Ub4 single frequency

SN 522-XXX: 4cm<sup>2</sup> head for Phyaction Ub



**Ref 332354: US-Head 1 MHz-4cm<sup>2</sup> Ub4, Phyaction Ub**  
Complete US head 4cm<sup>2</sup> for Phyaction Ub

To be ordered as a sales item

#### 10.1.2 Phyaction Ub model Ub1 single frequency

SN 523-XXX: 1cm<sup>2</sup> head for Phyaction Ub



**Ref 332365: US-Head 1 MHz-1cm<sup>2</sup> Ub1, Phyaction Ub**  
Complete US head 1cm<sup>2</sup> for Phyaction Ub

To be ordered as a sales item

#### 10.1.3 Pulson 100 model US104

SN 520-XXX: 4cm<sup>2</sup> head for Pulson 100



**Ref 332310: US-Head 1MHz 4cm<sup>2</sup> Pulson 100 (US104)**  
Complete US head for Pulson 100

To be ordered as a sales item

#### 10.1.4 Pulson 100 model US101

SN 521-XXX: 1cm<sup>2</sup> head for Pulson 100



**Ref 332221: US-Head 1MHz 1cm<sup>2</sup> Pulson 100 (US101)**  
Complete US head for Pulson 100

To be ordered as a sales item

**gymna**<sup>®</sup>  
for total support

### 10.2 US head evolution

### 10.2.1 Prototype series (only 4cm<sup>2</sup> heads)

520-0101 → 520-0146  
522-0101 → 522-0135

#### Serie related remarks:

Housing material PUR, LED cap 7mm. R&D series  
Bad tolerance of housing, rubber O-ring is glued and will easily brake → replace  
→ Quartz waterproof if ring well inserted, handle not  
→ **Service not possible**

### 10.2.2 First production series (only 4cm<sup>2</sup> heads)

Production > 21-12-2007

520-0147 → 520-0146  
522-0136 → 522-0155

#### Serie related remarks:

Housing material ABS, LED cap 5mm  
Better tolerance, quartz is pressed into housing  
Sometimes problems with fit of O-ring  
→ Quartz waterproof if ring well inserted, handle not  
→ **Service not possible**

### 10.2.3 Followed production series 1

Production > 01/2008

520-0179 → 0317  
521-0102 → actual  
522-0156 → 0253  
523-0102 → actual

#### Serie related remarks:

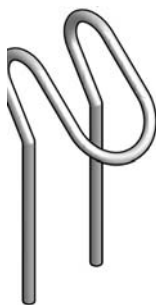
Quartz inserted after putting alcohol on rubber ring, to assure perfect fit of the O-ring  
→ Quartz waterproof, handle not  
→ **service not possible**

### 10.2.4 Followed production series 2

520-0318 → 520-0612  
522-0254 → 522-0431

#### Serie related remarks:

New quartz PCB with new type of springs:



→ Quartz waterproof, handle not  
→ **Service repairs are possible starting from this model**

### 10.2.5 Waterproof USH

520-0612 →  
521-01XX →  
522-0431 →  
523-01XX →

Serie related remarks:

New → Quartz and handle(glued) waterproof

### 10.3 US head calibration

The calibration of an ultrasound head needs to be done for single frequency units only. For multi frequency units the calibration data is read automatically when the US head is connected to the unit (eeprom in cable connector of US head)

The single frequency units come standard with a 4cm<sup>2</sup> US head. The calibration data of this head is already programmed during production.

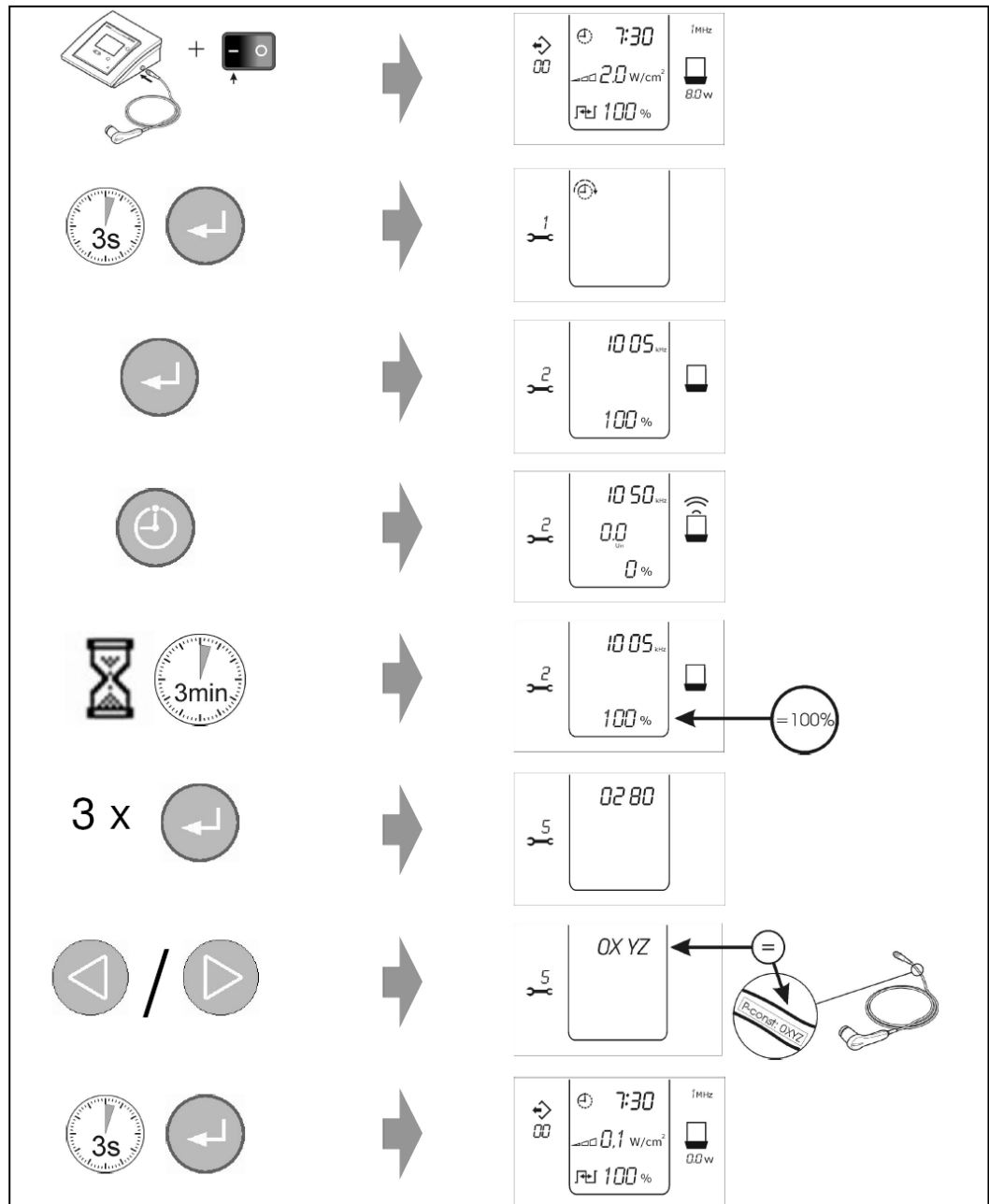
Calibration of US head(s) must be performed in the following cases

1. When customer buys a 1cm<sup>2</sup> head single frequency
2. When an ultrasound head is replaced by another one
3. In case of error 245
4. In case of main PCB replacement

The calibration of the US heads can be done via the system settings menu (standard procedure on the next page)

1. Connect the related US head (head must be 100% clean and dry!!) and switch on the unit
2. Press return key for 3 seconds → system program 1 appears
3. Press return key 1 time → system program 2 appears
4. Press timer key → tuning takes 3 minutes from 0% → 100%  
→ This results in a resonance frequency that will be saved automatically.  
→ the tuning procedure can be interrupted by pressing the return key for 3 seconds
5. Press return key 3 times → system program 5 appears
6. On the cable of the US head there is a label with the power factor (only for single frequency heads). This factor must be copied into the unit in system program 5
7. Exit the calibration module by pressing the return key for 3 seconds.

**Instructions for first use of the Ultrasound Treatment Head**  
**Instructies bij eerste gebruik van de Ultrageluid behandelkop**  
**Procédure d'initialisation lors de la première connexion de la tête d'ultrasons**  
**Anweisungen für den ersten Gebrauch des Ultraschallbehandlungskopfes**  
**Procedimiento de utilización para la primera conexión del Cabezal Ultrasonido**  
**Instruções para primeira utilização da Cabeça de Tratamento de Ultra-sons**  
**Procedura di utilizzo per il primo collegamento della Testina Ultrasuoni**





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## 11. Replacing main pcb

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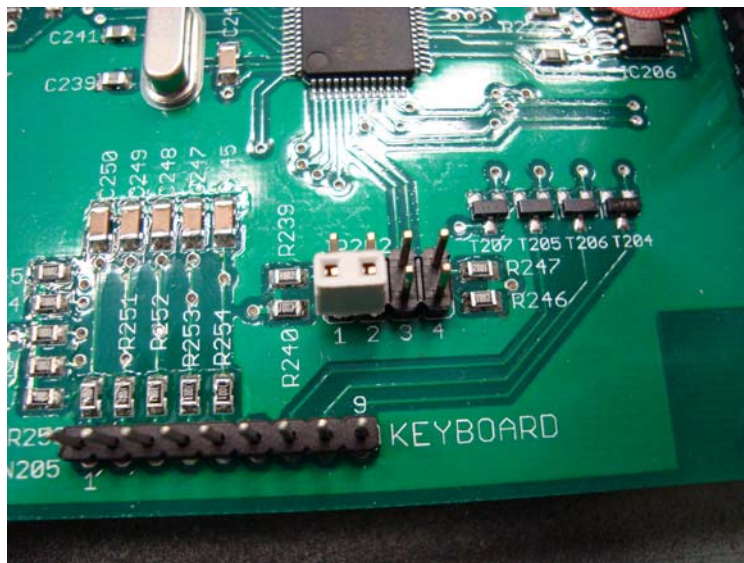
In case of a main PCB replacement there are some things to pay attention to.

### 11.1 Type of unit

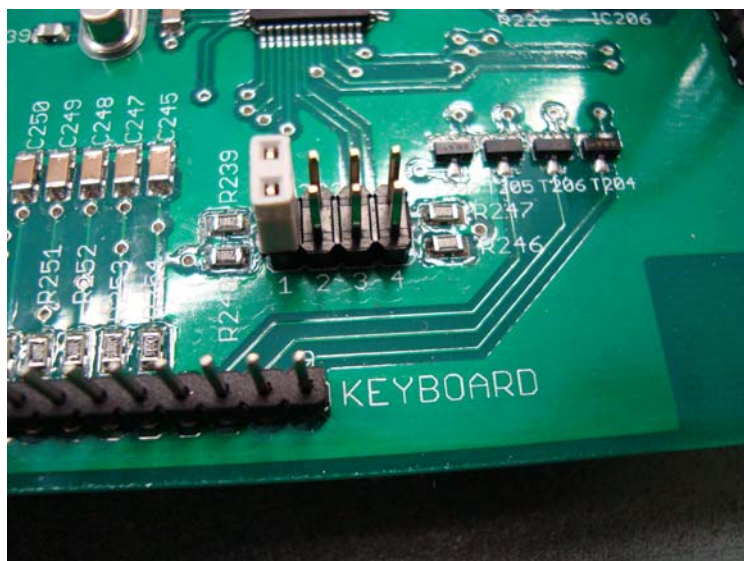
Jumper JP 202 must be set according to the type of machine, because of different keyboard structure.

For Pulson 100: remove Jumper (or put it horizontally)

For Phyaaction Ub: connect jumper between pin 1-2 (vertical)



Jumper setting for Pulson 100



Jumper setting for Phyaaction Ub

## **11.2 Calibration data**

In case a main PCB needs to be replaced, the calibration data need to set into the new PCB. For the units with single frequency US heads the US head calibration needs to be followed (power factor and resonance frequency set).

→ this procedure is explained in chapter

For units with multi frequency heads the calibration data is read automatically once the head is connected (eeprom in connector of US head)

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## ***12. Error codes***

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## **13. Hardware and software evolution**

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### **13.1 Single frequency units**

#### **13.1.1 Original configuration**

Hardware version 1AAA, sheet 3.0

Software version 1.00

Production before March 2007

SN < 08140000

#### **13.1.2 Hardware version 1ABA**

Hardware version 1ABA, sheet 3.1

Software version 1.01

Hardware:

Value R223 changed on 43K (old 36K)

Problem was instability of US frequency at some PCB's for frequencies below 1MHz

Software:

Service settings, menu 13: the frequency setting is possible with overflow (1050 kHz <-> 950 kHz).

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## ***14. Spare parts***

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