Sonopuls 492

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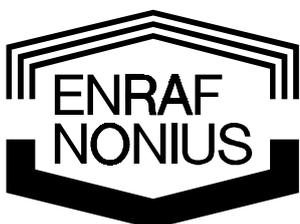# Sonopuls 492

Bedieningshandleiding
Operating Instructions
Gebrauchsanweisung
Mode d'emploi
Instrucciones de manejo

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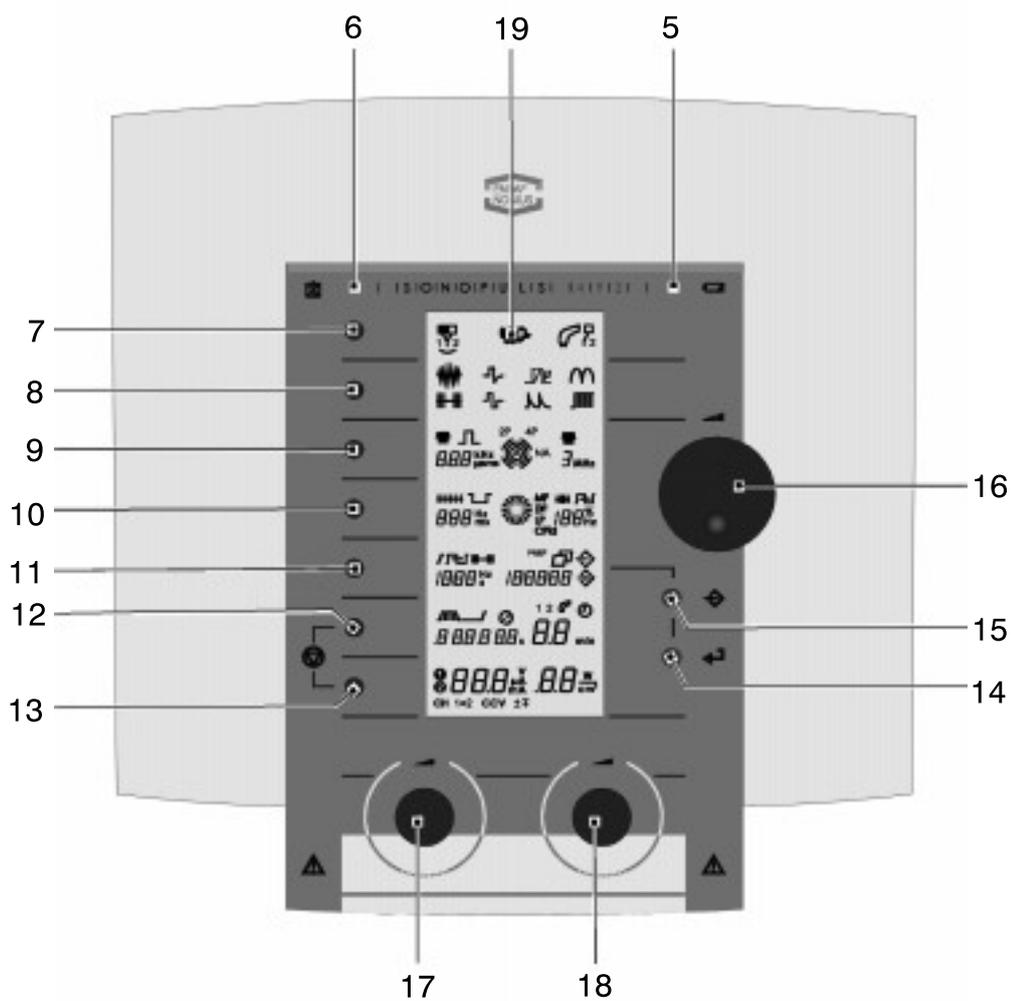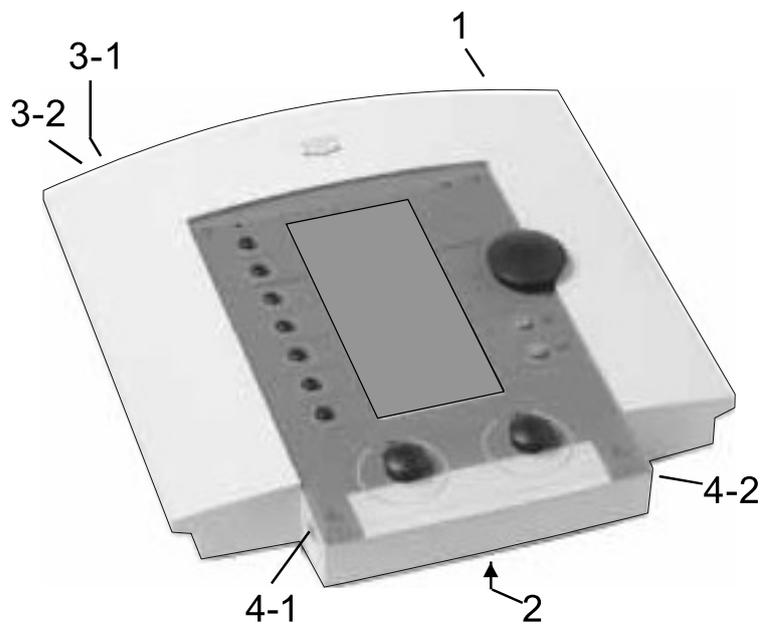NONIUS

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1.1. General

The Sonopuls 492 is equipped with two completely identical multi functional electrotherapy channels and a multifrequency ultrasound channel. The electrotherapy channels can be used in combination or totally independent. Combination of an electrotherapy channel with ultrasound is also possible providing the possibility of combination therapy. The remaining electrotherapy channel can meanwhile be used independently. These combination opportunities along with the largest possible quantity of available current waveforms make this apparatus the ultimate solution for your professional activities.

The apparatus is only meant to be used by competent personnel in physiotherapy, rehabilitation or adjacent areas.

1.2. Therapy possibilities

Ultrasound treatments with 1 & 3 MHz continuous and pulsed. Electrotherapy with low frequency, medium frequency, TENS, High Voltage and Microcurrent currents. Through the application of these currents it is amongst others possible to diminish muscle tone, manage pain and increase the circulation and regeneration of tissue. Combination therapy of ultrasound and electrotherapy is for instance ideal to localise trigger points and or pain points.

1.3. Multi-frequency treatment head

The ultrasound treatment heads for the Sonopuls 492 are so-called multi-frequency heads. Each treatment head can now supply both 1 and 3 MHz ultrasound. The heads are available with a large and small treatment surface and are also suitable for subaqual treatments.
The excellent beam characteristics, ergonomic design and effective contact control of the multi-frequency treatment heads make an optimal treatment possible.

1.4. Finally

You have made a wise choice in selecting the Sonopuls 492. We are confident that your unit will continue to give satisfaction over many years of use. Nevertheless, if you have any queries or suggestions, please contact your authorised distributor.

2.1. Preliminary notes

It is important that you read these operating instructions carefully before using the Sonopuls 492. Please make sure that these instructions are available to all personnel who operates the equipment.

Pay attention to the following before using the Sonopuls 492:
1. Keep yourself informed of the contra-indications (see chapter 3).
2. Never leave the patient unattended during treatment.
3. The apparatus may not be used in close proximity (i.e. less than 2 metres) to shortwave equipment.
4. The apparatus may not be used in so-called "wet rooms" (hydrotherapy rooms).

The manufacturer cannot be held responsible for the results of using this apparatus for any purposes other than described in these operating instructions.

2.2. General

When the apparatus is switched on all vital functions are checked by the internal microprocessor. During operation of the apparatus the actual output of the current is measured continuously and compared to the requested output. Whenever a faulty situation is detected the apparatus will switch off the current immediately.

2.3. Contact control at incomplete contact

When the treatment head only contacts partially with the body, the treatment is interrupted.
When not enough surface of the treatment head makes contact with the patient the treatment is interrupted (= contact control). The intensity display starts flashing and the treatment time is interrupted.

2.4. Exclusions

Electrotherapy is not intended for the following specific applications:
• Intercranial treatment, like sleep therapy;
• Transcordial treatments (applying electrodes at the thorax may increase the risk of heart fibrillation);
• Cervical occipital treatments.

2.5. Current density

The particular standard for Therapeutic Electrical Stimulation Equipment is IEC 60601-2-10 (BS 5724 part 2.10). The maximum permissible Current Density is 2 mA R.M.S. per cm^2. To verify that this value is not exceeded in electrotherapy, divide the current output in mA by the effective electrode area in cm^2; a value of less than two should result.

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Note that placing the electrodes should be done carefully and solidly, and that the use of small electrodes in combination with high intensities may cause skin irritations or burns.

2.6. Electromagnetic interference

Simultaneous connection of a patient to HF surgical equipment and an electrical stimulator must not be done as this may result in burns at the site of the stimulator electrodes. Therefore, simultaneous connection is not allowed. For more information see chapter 4, Installation.

2.7. Product liability

A law on Product Liability has become effective in many countries. This Product Liability law implies, amongst other things, that once a period of 10 years has elapsed after a product has been brought into circulation, the manufacturer can no longer be held responsible for possible shortages of the product.

2.7.1. Limitations of liability
To the maximum extent permitted by applicable law, in no event will Enraf-Nonius or its suppliers or resellers be liable for any indirect, special, incidental or consequential damages arising from the use of or inability to use the product, including, without limitation, damages for loss of goodwill, work and productivity, computer failure or malfunction, or any and all other commercial damages or losses, even if advised of the possibility thereof, and regardless of the legal or equitable theory (contract, tort or otherwise) upon which the claim is based. In any case, Enraf-Nonius's entire liability under any provision of this agreement shall not exceed in the aggregate the sum of the fees paid for this product and fees for support of the product received by Enraf-Nonius under a separate support agreement (if any), with the exception of death or personal injury caused by the negligence of Enraf-Nonius to the extent applicable law prohibits the limitation of damages in such cases.

Enraf-Nonius can not be held liable for any consequence resulting from incorrect information provided by it's personnel, or errors incorporated in this manual and / or other accompanying documentation (including commercial documentation)

The opposing party (product's user or it's representative) shall disclaim Enraf-Nonius from all claims arising from third parties, whatever nature or whatever relationship to the opposing party.

USA only:

Safety Precautions

This apparatus operates with high voltages. Servicing of the Sonopuls should be referred to qualified service technicians or returned directly to the distributor. To assure continued compliance with FDA 21 C.F.R. 1050.10 standards, the Sonopuls should be calibrated and safety tested at least once each year. The producer recommends that all service work be performed by the distributor. However, a service manual can be obtained by writing to the factory for those who are qualified to service the device and are fully aware of their responsibilities.

Caution:
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure to ultrasonic energy.

Please refer to the optional therapy books.

3.1. Indications

3.1.1. Indications Ultrasound
- conditions affecting joints, bone, muscle tissue;
- rheumatoid arthritis (not acute);
- affections of the peripheral nerves;
- affections of the blood circulation;
- affections of the internal organs;
- affections of the skin, scar tissue;
- Dupuytren's contracture;
- open wounds, decubitus ulcer, post-traumatic conditions.

3.1.2. Indications Electro therapy
Diagnostics, electropalpation for:
- pain points;
- trigger points;
- hyperaesthetic regions;
- motor trigger points;
- S/d curve

Therapy:

A. Pain control in:
- pain points;
- trigger points;
- hyperaesthetic regions.

B. Autonomic disorders such as:
- shoulder/hand syndrome;
- Raynaud's disease;
- Buerger's disease;
- Sudeck's dystrophy;
- neurological diseases;
- myalgia.

C. Muscle stimulation:
- for restoration of kinaesthesia;
- for treatment of atrophy;
- for stimulation of the internal and external sphincters in the treatment of urinary incon-tinence;
- revalidation;
- muscle strengthening (sport);
- neurological conditions.

D. Iontophoresis.

E. Wound healing:
- skin lesions due to circulation disorders;
- post-operative wounds.

3.1.3. Indications (combined therapy)
- myofascial trigger points;
- referred sensation;
- incipient neurogenous inflammation.

3.2. Absolute specific contra-indications

3.2.1. Absolute specific contra-indications Ultrasound
- eyes;
- heart;
- pregnancy;
- epiphysial discs;
- brain tissue;
- testicles.

3.2.2. Contra-indications Electro therapy
- pyrexia;
- tumours;
- tuberculosis;
- localized inflammation;
- thrombosis;
- pregnancy;
- pacemakers;
- metal implants.

3.2.3. Contra-indications Combined therapy
As for ultrasound and electrotherapy.

3.3. Relative specific contra-indications (Ultrasound)

- status post laminectomy;
- loss of sensation;
- endoprostheses;
- tumours;
- post-traumatic sequelae;
- thrombophlebitis and varices;
- septic inflammation;
- diabetes mellitus.

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4.1. Connection

- Mains supply connections must comply with the national requirements regarding medical rooms. The equipment has a safety earth (ground) connection, and must be connected to an earthed (grounded) wall socket.
- Prior to connection of this apparatus to the mains supply, check that the voltage and frequency stated on the type plate correspond with the available mains supply.
- The mains adapter is a part of the supply circuit on which the device's safety partly depends. The approvals for the Sonopuls 492 are only valid if used in combination with this type of adapter ENA 1550.

⚠ It is not permitted to connect the Sonopuls 492 to another type of adapter than type ENA-1550.

4.2. Connection of the mains adapter

- Connect the supplied mains adapter to the connector [3-1].
- Connect the mains adapter to a wall socket. Lamp [6] indicates that the apparatus is connected to the mains supply and stand-by.

4.3. Switching on and self test

- Switch On the apparatus, using the On/Off switch [1]
- Immediately after switching on, the apparatus carries out a self test.

At the end of the self-test a beep is heard. When an error is found an error code will appear on the display. See section 7 for details.

4.4. Disconnecting from the mains

- Switch Off the Sonopuls 492, using the On/Off switch [1].
- Pull out the mains plug of the mains adapter from the wall socket.

4.5. Battery operation (optional)

The apparatus can be operated independent of the mains supply. To make this possible, first a battery must be installed. This is done as follows:
- Turn off the apparatus and remove the mains adapter from connector [3-1].
- Put the apparatus upside down and remove the two screws fixating the battery compartment cover to the bottom of the apparatus.
- Connect the red lead to the positive (+) pole of the battery and the black lead to the negative (−) pole.
- Slide the battery into its compartment.
- Reattach the battery compartment cover using the two screws.
- Reconnect the mains adapter to connector [3-1].

With a mains adapter connected, the battery is automatically charged, independent of the state of the on/off switch [1]. We recommend to use the apparatus with the mains adapter connected whenever possible. This will increase the service life of the battery.

We recommend to explicitly use Enraf-Nonius supplied batteries of type 2601.016. The battery contains material that is noxious to the environment. You should attend the local regulations when disposing the battery. See also chapter 6.4.

4.6. Installation

- Do not install the apparatus in a location near a heat source such as a radiator.
- Avoid exposure to direct sunlight, rain, excessive dust, moisture, mechanical vibrations and shocks.
- Cordless telephones should not be used in close proximity of the apparatus.
- This apparatus should not be used in so-called "wet- rooms" (hydrotherapy rooms).
- The apparatus has to be installed in such way that liquid cannot enter.
- It is not permitted to connect the Sonopuls 492 to another type of adapter than type ENA-1550.

Should any liquid ingress into the housing of this equipment, unplug the apparatus from the wall socket (if connected) and have it checked by an authorised expert.

⚠ Connection of accessories other than ones specified by the manufacturer can adversely affect the safety of the patient and correct functioning of the equipment, and is therefore not permitted.

4.7. Electromagnetic interference

- Operation in close proximity (i.e. less than 2 metres) to working shortwave or microwave therapy units may produce instability in the Sonopuls 492 output.
- To prevent electromagnetic interference, we strongly advise using separate mains groups (phases) for the Sonopuls 492 and the shortwave or microwave equipment, and a distance of at least 2 metres is kept between the Sonopuls 492 and the shortwave or microwave equipment.
- Ensure that the mains cable of the shortwave/microwave unit does not come near the Sonopuls 492 or the patient.

If problems with electromagnetic interference persist, please contact your authorised distributor.

5.1. Controls

(See jacket flap)

5.1.1. Device

[1] On/Off Power switch
With this switch the Sonopuls 492 is switched On/Off.

[2] Type number/warning sticker
Provides information on the apparatus, such as type and serial number, as well as connection data such as mains voltage and maximum current consumption.

[3-1] Connector for mains adapter

[3-2] Connector for remote control
For connection of the optional remote control.

[4-1] Connection Patient Cable Electrotherapy

[4-2] Connection Ultrasound treatment head

5.1.2. Control panel

[5] Battery indicator
There are four possibilities:
- Lights green : battery is fully charged
- Lights blinking
  green : battery partial discharged, connect mains adapter
- Lights yellow : battery insufficiently charged, therapies disabled, connect mains adapter
- Off : no battery present, battery fully discharged or defective, connect mains adapter

[6] Mains adapter indicator
This lamp indicates that the mains adapter is connected to the power supply.

[7] Therapy options
Selection button for electrotherapy, current channel selection, linked current channels, interval between program steps, ultra sound therapy and combination therapy.

[8] Selection button current waveform
This button is to select the different current waveforms.

[9] Selection button for
Carrier wave, pulse width, microcurrent frequency, interferential current type, alternating mode (High Voltage and Microcurrent) and ultrasound frequency

[10] Selection button for
Beat frequency, phase interval, burst frequency (Russian stimulation), vector position, balance position, Diadynamic current waveforms, modulation frequency (spectrum) and ultra sound duty cycle.

[11] Selection button for
Modulation time (spectrum), duty cycle (Russian stimulation), burst frequency (TENS) and treatment step number (protocols)

[12] Selection button for
Surge programme, vector rotation time and treatment timer

[13] Selection button for
Current channel, CC/CV mode, polarity and ultrasound unity

[12]+[13] Emergency stop.
Pressing buttons [12] and [13] simultaneously will terminate all active treatments.

[14] Accept button
To accept the current waveform selection, the pre-programmed protocols and to start the surge programs.

[15] Memory button
To generate the memory functions and to recall and store programs

[16] Central controller
Controller to adjust all settings and parameters.

[17] Intensity controller
Controller to adjust the current intensity in channel 1 and 2. In 4-pole mode (interferential currents) this controller adjusts the intensity in both channels together.

[18] Intensity controller ultrasound
Controller to adjust the intensity for ultrasound.

[19] Interval symbol
The symbol 🐾 indicates the interval between two program steps of a sequential program.

5.2. Operating the apparatus

5.2.1. Introduction

5.2.1.1. Switch on the apparatus
Turn the apparatus on with switch [1]. The apparatus executes a self test, checking all important functions and presents itself with the start up settings. The start up settings are adjustable at memory location 0. To personalise the start up settings, refer to chapter 5.4, Memory Functions.

5.2.1.2. Therapy and channel selection
The Sonopuls 492 is equipped with two electrotherapy channels and one ultrasound channel. These channels can be used independently, each channel offering its own set of parameters and treatment timer. It is also possible to link channels. Use button [7] to differentiate between the basic therapy functions Electrotherapy and Ultrasound therapy and use the central controller [16] to select or link channels. The following selections are available:

▬ᵧ₁	electrotherapy on current channel 1
▬ᵧ₂	electrotherapy on current channel 2
▬ᵧ₁₂	electrotherapy on linked channels
⌒	ultrasound therapy
⌒ ⌒₂	combination therapy (ultrasound therapy linked to current channel 2)

Consider that independent use of the electrotherapy channels requires adjusting all parameters on both channels. When this is not desired, or when independent use is not needed, you can also link the channels. Some waveforms, such as interferential currents are only possible on linked channels. When you select combination therapy, current channel 1 remains available for independent use.

5.2.1.3 Selection of current waveform
Press button [8]. All waveforms appear on the display, the currently selected one blinking. Select a current waveform using the central controller and press button [14] to accept the selection. When you select ⋀⋁⋀⋁ (interferential current group) or ∩∩ (Diadynamic current group), you will be requested to select a current type within this group. Select the current type using the central controller [16] and press button [14] to accept the selection.

5.2.1.4 Adjusting parameters
Press the buttons [9] thru [13] to select a parameter. A button effects all parameters that are in line with it on the display. Once selected a parameter can be adjusted, using the central controller [16]. A parameter can be modified, as long as the icon identifying it is blinking. The display will only show those parameters, that are applicable to the selected therapy.

5.2.1.5 Treatment timer
Press button [12] to select the treatment timer. The **min** icon is blinking. The display shows the treatment time of the channel, that is currently present (selected under 5.2.1.2.) on the display. As a reminder, a channel indicator is blinking above the treatment timer value. Only the treatment timer of this channel can now be modified, using the central controller [16].
When one or more channels are active ⊕ is blinking. An indication of the currently active channels is available above the treatment timer value.

5.2.1.6. Surge programs
Some current waveforms can be embedded in a surge program. Press button [12] to sequentially select ramp up time ⌐, hold time ∏, ramp down time ⌐ and interval time ____. Adjust these parameters using the central controller [16].
When the current channels are linked, the surge programs are identical on both channels. In this mode a delay time can be set between the start of the surge program on channel 1 and on channel 2. This is done as follows:
Press button [13] and select channel 2 using the central controller [16].
Next press button [12] to select the delay time ____/ and adjust it using the central controller [16].

5.2.1.7. Current intensity
The current intensity is adjusted using intensity controller [17]. The current intensity can only be adjusted when the clock has been set.
The channel indicator **CH**, followed by the channel number **1** or **2** indicates the channel, that is currently present on the display and that can be adjusted. You can change the channel number, using button [13] and the central controller [16]. This selection operates in parallel to the channel selection described in paragraph 5.2.1.2.
At 4-pole current waveforms the intensity controller [17] operates on both channels simultaneously. On the display this is indicated by **1+2**, in which the channel that is currently displayed is blinking. In this case a balance control facility is available for the classical interferential current waveform (see paragraph 5.2.2.9. for details).
The unity of the displayed current intensity depends on the previously selected current waveform and can be expressed in **mA**, **µA** or **V**.
A treatment is started by adjusting the current intensity, unless a surge program has been selected. Press button [14] to start a treatment that includes a surge program.
The indicators ❶ and ❷ will show up when current is actually flowing from the corresponding channels. A blinking current intensity value indicates a poor electrical contact with the patient.

5.2.1.8. CC/CV mode

Depending on the selected current waveform, the electrotherapy channels can be used in the Constant Current or Constant Voltage mode. It is advised to use the CV mode with dynamic electrode applications. In CV mode the output current depends on the electrical contact with the patient and can therefore vary. You can change the CC/CV setting using button [13] and the central controller [16].

5.2.1.9. Current polarity

When DC currents are used, the red terminal is the positive terminal and the black one the negative terminal. To manually change the polarity, press button [13] and select ± or ∓ using the central controller [16]:

± : Standard
∓ : reversed

Manually changing the polarity during a treatment will result in a current decaying to 0, followed by a current with the opposite polarity, rising to a value equal to 80% of the previous value.

To activate automatic polarity reversal of the The High voltage and Microcurrent waveforms, select **A** or **NA** with button [9] and the central controller [16]:

A   : alternating
NA : not alternating

With the Interrupted DC current waveform it is not possible to reverse the current polarity.

5.2.1.10. Ultrasound intensity

The ultrasound intensity is adjusted with intensity controller [18]. The ultrasound intensity can only be adjusted when the clock has been set.

The ultrasound intensity can be displayed in **W** or $\frac{W}{cm^2}$. You can change this setting using button [13] and the central controller [16].

5.2.1.11. Emergency stop

Pressing buttons [12] and [13] simultaneously will terminate all active treatments.

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5.2.2. Electrotherapy

5.2.2.1. 2-pole interferential current (premodulated)
- Push button [7] to select ⬚. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⟋⟍⟋⟍ with the central controller [16] and press button [14] to accept;
- Selection of 2-pole interferential current:
  Select **2P** with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select ⟋⟍⟋⟍ (kHz) and adjust its value with the central controller [16];
- Beat frequency:
  Select ┼┼┼┼┼ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ┼┼┼ with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ╱ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Surge program (when desired):
  - Ramp up time:
    Select ⟋ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⟍ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ___ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ___╱ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.2. Russian stimulation
- Push button [7] to select ⬚. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ╫╌╫ with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select ⟋⟍⟋⟍ (kHz) and adjust its value with the central controller [16];
- Burst frequency:
  Select ┼┼┼┼┼ with button [10] and adjust its value with the central controller [16];
- Burst / interval ratio:
  Select ⊓↔⊓ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Surge program (when desired):
  - Ramp up time:
    Select ⟋ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⟍ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ___ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ___╱ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.3. Asymmetrical and Symmetrical biphasic pulsed current (TENS)

- Push button [7] to select ⚕. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⌐⌐ or ⌐⌐ with the central controller [16] and press button [14] to accept;
- Pulse width:
  Select ⌐Ĺ with button [9] and adjust its value with the central controller [16];
- Beat frequency:
  Select ┼┼┼┼ with button [10] and adjust its value with the central controller [16];
- Make your choice between frequency modulation and burst mode as these two options are mutually exclusive;
- If frequency modulation is desired:
  First check burst mode to be off:
  - Select ┼┼┼─┼┼┼ with button [11] and set its value to zero with the central controller [16];
  - Modulation frequency (spectrum):
    Select ┼┼┼┼ with button [10] and adjust its value with the central controller [16];
  - Modulation time (Spectrum):
    Select ∫ with button [11] and adjust its value with the central controller [16];
- If burst mode is desired:
  First check frequency modulation to be off:
  - Select ┼┼┼┼ with button [10] and set its value to zero with the central controller [16];
  - Burst frequency:
    Select ┼┼┼─┼┼┼ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ⌚ with button [12] and adjust its value with the central controller [16];
- Surge program (when desired):
  - Ramp up time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ___ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ___/ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.4. Monophasic rectangular –and triangular pulsed current

- Push button [7] to select ⚕. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⌐Ĺ or _/Ĺ with the central controller [16] and press button [14] to accept;
- Pulse width:
  Select ⌐Ĺ with button [9] and adjust its value with the central controller [16];
- Pulse interval:
  Select ⌐__⌐ with button [10] and adjust its value with the central controller [16];
- Treatment time:
  Select ⌚ with button [12] and adjust its value with the central controller [16];
- Surge program (when desired):
  - Ramp up time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ___ with button [12] and adjust its value with the central controller [16];

- Delay time (only available with linked channels):
  Push button [13] and select channel 2 with the central controller [16].
  Select ____/ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Polarity:
  Select ± or ∓ with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.5. Microcurrent

- Push button [7] to select ⌨. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⊓ᴾ with the central controller [16] and press button [14] to accept;
- Frequency:
  Select ⋙ (Hz or kHz) with button [9] and adjust its value with the central controller [16];
- Alternating or not alternating:
  Select A or NA with button [9] and the central controller [16];
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Alternation sequence (only with A selected):
  - Ramp up time:
    Select ⌡ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⅃ with button [12] and adjust its value with the central controller [16];
- Surge program (only with NA selected):
  - Ramp up time:
    Select ⌡ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⅃ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ____ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ____/ with button [12] and adjust its value with the central controller [16];
- Polarity (only with NA selected):
  Select ± or ∓ with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.6. High voltage

- Push button [7] to select ⌨. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⋀⋀ with the central controller [16] and press button [14] to accept;
- Alternating or not alternating:
  Select A or NA with button [9] and the central controller [16];
- Beat frequency:
  Select ⊦⊦⊦⊦ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ⊪ (%) with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ⌡ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];

- Alternation sequence (only with **A** selected):
  - Ramp up time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
- Surge program (only with **NA** selected):
  - Ramp up time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ▬▬▬ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ▬▬▬/ with button [12] and adjust its value with the central controller [16];
- Polarity (only with **NA** selected):
  Select ± or ∓ with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.7. Diadynamic currents
- Push button [7] to select ⚏. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⋂ with the central controller [16] and press button [14] to accept;
- Select MF, DF, LP, CP or CPid with the central controller [16] and press button [14] to accept;
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Surge program (only with MF and DF):
  - Ramp up time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Hold time:
    Select ⊓ with button [12] and adjust its value with the central controller [16];
  - Ramp down time:
    Select ⌐ with button [12] and adjust its value with the central controller [16];
  - Interval time:
    Select ▬▬▬ with button [12] and adjust its value with the central controller [16];
  - Delay time (only available with linked channels):
    Push button [13] and select channel 2 with the central controller [16].
    Select ▬▬▬/ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Polarity:
  Select ± or ∓ with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.8. Medium frequency interrupted direct current
- Push button [7] to select ⚏. Use the central controller [16] to select the desired channel or to link the channels;
- Push button [8], select ⊪⊪ with the central controller [16] and press button [14] to accept;
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the current intensity with controller [17];
- Polarity:
  Select ± or ∓ with button [13] and the central controller [16];
- Select the desired channel with button [13] and the central controller [16]. Adjust the intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

5.2.2.9. 4-pole interferential current (classical)

- Push button [7] to select ⬚. Use the central controller [16] to link the channels;
- Push button [8], select 〜 with the central controller [16] and press button [14] to accept;
- Selection of 4-pole interferential current:
  Select **4P** with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select 〜 (kHz) and adjust its value with the central controller [16];
- Beat frequency:
  Select ┤┤┤┤ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ╫╫ with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ∫ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ◔ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Adjust the current intensity with controller [17];
- Balance:
  Select ⋈ with button [10] and adjust its value with the central controller [16]

5.2.2.10. Isoplanar vector

- Push button [7] to select ⬚. Use the central controller [16] to link the channels;
- Push button [8], select 〜 with the central controller [16] and press button [14] to accept;
- Selection of isoplanar vector current:
  Select ◎ with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select 〜 (kHz) and adjust its value with the central controller [16];
- Beat frequency:
  Select ┤┤┤┤ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ╫╫ with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ∫ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ◔ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Adjust the current intensity with controller [17]

5.2.2.11. Dipole vector manual

- Push button [7] to select ⬚. Use the central controller [16] to link the channels;
- Push button [8], select 〜 with the central controller [16] and press button [14] to accept;
- Selection of manual dipole vector current:
  Select ◇ with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select 〜 (kHz) and adjust its value with the central controller [16];
- Beat frequency:
  Select ┤┤┤┤ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ╫╫ with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ∫ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ◔ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Adjust the current intensity with controller [17];
- Dipole vector:
  Select ↗ with button [10] and adjust the position with the central controller [16]

5.2.2.12. Dipole vector automatic
- Push button [7] to select ⬚. Use the central controller [16] to link the channels;
- Push button [8], select ⩗⩗⩗ with the central controller [16] and press button [14] to accept;
- Selection of automatic dipole vector current:
  Select ⊘ with the central controller [16] and press button [14] to accept;
- Carrier wave selection:
  Push button [9] to select ⩗⩗⩗ (kHz) and adjust its value with the central controller [16];
- Beat frequency:
  Select ┼┼┼┼ with button [10] and adjust its value with the central controller [16];
- Modulation frequency (spectrum):
  Select ╫╫╫ with button [10] and adjust its value with the central controller [16];
- Modulation time (spectrum):
  Select ∫ with button [11] and adjust its value with the central controller [16];
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Rotation speed
  Select ⊘ with button [12] and adjust its value with the central controller [16];
- Select CC or CV with button [13] and the central controller [16];
- Adjust the current intensity with controller [17].

5.2.3. Ultrasound
- Select ⌒⌒ with button [7] and select ⌒ with the central controller [16];
- Ultrasound frequency:
  Select ⩗⩗⩗ (MHz) with button [9] and adjust its value with the central controller [16];
- Continuous or pulsed operation:
  Select ⌐±⌐ with button [10] and adjust its value with the central controller [16]:
  - Continuous = 100 %;
  - Pulsed = 80%, 50%, 20%, 15%, 10% and 5 % with a frequency of 100Hz;
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Select W or W/cm² with button [13] and the central controller [16];
- Adjust the ultrasound intensity with controller [18];
- Apply the ultrasound treatment head to the patient, at sufficient acoustical contact the applicator light will be switched off and the treatment will be started.

5.2.4. Combination therapy
- Select ⌒⌒ with button [7] and select ⌒⌒ with the central controller [16];
- Ultrasound frequency:
  Select ⩗⩗⩗ (MHz) with button [9] and adjust its value with the central controller [16];
- Continuous or pulsed operation:
  Select ⌐±⌐ with button [10] and adjust its value with the central controller [16]:
  - Continuous = 100 %;
  - Pulsed = 80%, 50%, 20%, 15%, 10% and 5 % with a frequency of 100Hz;
- Push button [8], select a current waveform with the central controller [16] and press button [14] to accept;
- Set all electrotherapy parameters according to paragraph 5.2.2;
- Treatment time:
  Select ⊕ with button [12] and adjust its value with the central controller [16];
- Select W or W/cm² with button [13] and the central controller [16];
- Adjust the ultrasound intensity with controller [18];
- Apply the red electrode from channel 2 to the patient;
- Apply the ultrasound treatment head to the patient, at sufficient acoustical contact the applicator light will be switched off and the treatment will be started;
- Adjust the current intensity on channel 2 with controller [17].

Attention: when combination therapy is selected, the apparatus will automatically select CV mode. To change to CC mode, push button [13] and select CC with the central controller [16].

5.3. Measures with regard to treatments

5.3.1. Electrotherapy
Before treatment
- Check the patient for absolute and relative contraindications.
- Test the heat sensibility of the treatment area.
- If the skin is hairy shaving is the best.

5.3.2. Ultrasound
Before the treatment
- Check the patient for absolute and relative contraindications.
- Test the warmth sensibility of the treatment area.
- Clean the skin of the treatment area with soap or a 70% alcohol solution, to optimise the ultrasound transmission.
- Strong hair grow has to be shaved.

During the treatment
- The treatment head has to be moved, also with the semi-static method, constantly.
- Ask the patient regularly for his/her findings. If necessary the treatment will be adjusted. The intensity can be reduced or the continuous mode can be changed to pulsed mode or vice versa.
- When there are signs that the ultrasound transmission is bad, add more contactgel or move this with the treatment head.

After the treatment
- Clean the skin of the patient and the treatment head with a towel or tissue. Furthermore clean the treatment head with a 70% alcohol solution.
- Check the effects that can be expected (for example pain, circulation and mobility).
- Ask the patient to inform any reactions to the therapist.

5.3.3. Combination therapy

See both chapters 5.3.1. Electrotherapy and 5.3.2. Ultrasound.

5.4. Memory functions

The Sonopuls 492 is equipped with a memory to store equipment settings and protocols.

5.4.1. Equipment settings
Equipment settings store all parameters of the apparatus, except the current intensity. Contrary to protocols, equipment settings operate on all channels together, including the ultrasound channel. Equipment settings are stored at locations 0 - 9. The location number will appear on the display when button [15] is pushed. Equipment setting 0 is automatically loaded when the apparatus is turned on. Equipment settings can only be loaded and stored when all channels are inactive.

5.4.1.1. Loading equipment settings
- Push button [15], ⬦ is blinking;
- Select a memory location in the range of 0 - 9 with the central controller [16]. The display shows the equipment settings that are stored at the selected location;
- Push button [14] to load the selected equipment settings;
- Adjust the current intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

Loading the selected equipment settings has to occur within a certain time delay as long as ⬦ is blinking. Waiting too long, or pushing any other button than [14] or [15] will cancel the load operation.
.

5.4.1.2. Storing equipment settings
- Select a therapy and set all parameters on all desired channels;
- Push button [15], ⬦ is blinking;
- Select a memory location in the range of 0 - 9 with the central controller [16]. The display shows the equipment settings that are stored at the selected location, allowing you to check what will be overwritten;
- Push button [15] a second time, ⬦ is blinking. The display now shows the current equipment settings that are to be stored at the selected location;
- Push button [14] to execute the store operation.

Execution of the store operation has to occur within a certain time delay as long as ⬦ is blinking. Waiting too long, or pushing any other button than [14] or [15] will cancel the store operation.

5.4.2. Protocols
A protocol consists of one or more treatment steps that are sequentially executed. Each treatment step has its own current waveform, parameter settings and treatment time. The protocols are categorised in clusters according to their application. Protocols are identified as follows:

1:1 the first number is the cluster number
1:1 the second number is the protocol number

The Sonopuls 492 provides a number of pre-programmed protocols, that are available at cluster 2 and higher. Each cluster is intended for a specific indication. In the therapy guide that is supplied with the apparatus you will find a survey of all clusters and the corresponding protocols. Additionally the Sonopuls 492 supports user defined protocols, for which cluster 1 has been reserved.

Electrotherapy protocols can constitute either single or dual channel applications. Prior to loading a single channel protocol, first the target channel must be specified. In this case it is also allowed to link the current channels, causing the protocol to be executed on both channels. When a single channel protocol is being executed, a completely different single channel protocol can be executed at the other channel. Of course dual channel protocols can only be loaded when the current channels are linked.

5.4.2.1. Loading a protocol
- Select a target channel, using button [7] and the central controller [16];
- Push button [15], ⇨ is blinking;
- Select a protocol number in the range of 1:1 and higher with the central controller [16]. The display shows the total treatment time of the selected protocol;
- Push button [14] to load the selected protocol;
- Adjust the current intensity with controller [17];
- Push button [14] to start the therapy in case a surge program was selected.

When a protocol is executed, the display shows the remaining treatment time of the running treatment step. Each treatment step is terminated with a short beep. When the end of the protocol has been reached, a standard "end-of-treatment" beep is given, after which the apparatus will exit the protocol mode.

Notes:
- To indicate the protocol mode the protocol number remains visible on the display once a protocol has been loaded. Following the protocol number, the treatment step number is shown, accompanied by its icon ⌑.
- To remove a loaded but not yet executing protocol, push button [14] again. By waiting a moment, or by pushing any other button than [14] or [15], the apparatus will exit the protocol mode.
- All parameters of a loaded protocol can be changed at will. Select ⌑ with button [11] and select the treatment step number with the central controller [16]. All parameters of the now selected treatment step can be changed. Do not forget to reset the treatment step number to 1.
- A loaded protocol can be executed starting from any treatment step. Select ⌑ with button [11] and select the treatment step number with the central controller [16].
- The execution of a treatment step can be terminated by advancing the treatment step number. Select ⌑ with button [11] and select the new treatment step number with the central controller [16]. The current will decay to zero. You can resume the execution of the protocol from the new treatment step by adjusting the current intensity with controller [17].

- The execution of a protocol can be terminated, by setting the treatment time of the running treatment step to zero. The apparatus will then exit the protocol mode.

5.4.2.2. Storing a protocol
Prior to the execution of a modified protocol, it can be saved for later use in cluster 1:
- Push button [15] twice. ⇨ is blinking;
- Select a protocol number in the range of 1:1 - 1:9 with the central controller [16]. The display shows the total treatment time of the protocol to be stored;
- Push button [14] to execute the store operation.

5.4.2.3. Creating a user defined protocol
In cluster 1 you can create your own protocols. A maximum of 10 protocols can be stored, each with a maximum length of 20 treatment steps. Before you proceed with the steps below, first make sure that the apparatus is not in protocol mode (see section 5.4.2.1. how to exit protocol mode):
- Push button [15] twice. ⇨ is blinking;
- Select a protocol number in the range of 1:1 - 1:9 with the central controller [16];
- Push button [14]. ⇨ is blinking, ⌑ is visible and the treatment step number is set to 1.
- Set all parameters of the current treatment step;
- Push button [14] to store the treatment step. The treatment step number is automatically incremented;
- Repeat the previous two steps until the end of your protocol has been reached;
- Terminate your protocol with a treatment step with a treatment time of zero. Push button [14] to confirm. The end of your protocol is confirmed with a beep.

Notes:
- When two consecutive treatment steps contain AC current waveforms or identical wave forms, the current intensity will be maintained at the adjusted level when the protocol is executed.
- When switching to or between different DC current waveforms, the current intensity will be decayed to zero. The next treatment step will have to be started manually by adjusting the current intensity.

5.5. The treatment head

A treatment head is a precision instrument. Great care is taken in the development and production in order to obtain the best possible beam characteristics. Rough treatment (jarring or dropping) can adversely affect these characteristics, and must therefore be avoided.

5.6. The contact medium

In order to ensure efficient transfer of energy, a contact medium is required between the treatment head and the body. Air causes virtually total reflection of the ultrasound energy. The best medium for the transfer of ultrasound energy is a gel.

- For preference, use Enraf-Nonius Contact-Gel, as this allows the excellent characteristics of the treatment heads to be used to their full advantage.
- The gel should be applied to the part of the body to be treated and then spread out with the treatment head.
- Never apply the gel to the treatment head. The treatment head will register this as contact and may emit ultrasound energy, which could damage the treatment head.

If the body surface is very irregular, making it difficult to obtain good contact between the treatment head and the body, or if direct contact must be avoided (e.g. due to pain), the affected area may be treated under water (subaqual method). The water should be degassed (by previous boiling) in order to prevent air bubbles arising on the treatment head and the body.

5.7. Contact control at incomplete contact

When the treatment head only contacts partially with the body, the treatment is interrupted. When not enough surface of the treatment head makes contact with the patient the treatment is interrupted (= contact control). The intensity display starts flashing and the treatment time is interrupted. The contact control does not function at a set intensity of 0.1 and 0.2 W/cm².

5.8. Combination therapy

The treatment surface of a connected treatmenthead is connected to the negative electrode (cathode) of the current current channel 2. This connection is only available when combination therapy is selected.
Remove the negative electrode (black plug) of the electrode cable. The current flows between the positive electrode (red plug) and the treatmenthead.

5.9. Connection and disconnection reactions

Constant Current (CC) output characteristics may cause unpleasant connection and disconnection reactions if the electrodes are not securely placed or lose contact with the skin. Make sure the output is set to 0 mA when you apply or remove the electrodes. Preferably use Constant Voltage (CV) in case of dynamic application techniques.

5.10. Electrolytic effects

Electrolysis occurs under the electrodes when current types with a DC component are applied. Because the greatest concentration of electrolytic by-products caused by ion migration occur under the electrodes, we recommend the use of the supplied sponges to keep the effects to a minimum. Make sure that the sponges are kept well moistened and place the thick side of the sponge between the flexible rubber electrodes and the patient.

5.11. Remote control

For the Sonopuls 492 a special remote control is available. The remote control can be connected to connector [3-2]. The remote control has 2 intensity buttons for setting the intensity of the current channels and an emergency stop.

USA only:

Ultrasound emission can be terminated in the following ways:
A. Lifting the treatment head from the patient. Because of the loss of acoustic contact the Sonopuls 492 stops emission.
B. Decrease the treatment time to zero with the time setting control.
C. Switch the power off by use of the power switch.

6.1. Technical maintenance

Electrical safety of the apparatus depends on the electrical connection (via the power cord) to protective earth. It is therefore necessary to have this connection checked annually. Further an annual overall check is recommended. This may be done by your supplier, or by another agency, authorised by the manufacturer. It is also recommended that a record of the service history is kept for all activities relating to service and maintenance. In some countries this is even obligatory.

Maintenance and all repairs should only be carried out by an authorised agency. The manufacturer will not be held responsible for the results of maintenance or repairs by unauthorised persons.

The service and/or maintenance must be carried out conform the procedure described in the service manual of the apparatus.

Opening of the equipment by unauthorised agencies is not allowed and will terminate any claim to warranty.

6.2. Cleaning of the apparatus

Switch off the apparatus and disconnect it from the mains supply. The apparatus can be cleaned with a damp cloth. Use lukewarm water and a non-abrasive liquid household cleaner (no abrasive, no alcohol content solution).

6.3. Cleaning of accessories

6.3.1. Electrodes and sponge pads
The rubber electrodes should be cleaned with lukewarm water. For stubborn stains or dirt, cleaning and disinfection of the rubber electrodes can be done using a 70% alcohol solution. During this process, the black colouration of the rubber electrodes may be stained. This does not affect the operation of the electrodes.

The sponge pads must be washed after use in warm water with a household cleaner. Then they must be rinsed with water, drained thoroughly and then dried, after they have been placed like roofing tiles. Damaged sponge pads must be replaced.

In areas where the water is soft, it is possible that the water may conduct poorly resulting in abnormally low currents. In this case it is possible to use a saline solution to improve the conductivity of the water.

When the electrodes are not being used, the sponge pads should be removed. This increases the operational life of the rubber electrodes. We advise that you should keep an extra set of sponge pads in stock.

6.3.2. Treatment heads
The treatment heads and cables should be regularly inspected for damage, e.g. hairline cracks, which could allow penetration by liquids. Clean the contact surface immediately after each treatment. Make sure that no ultrasound gel remains on the treatment head. We further recommend cleaning the head and cable daily, using lukewarm water.
The treatment heads can be disinfected using a cloth moistened with 70% alcohol.

6.3.3. Patient cable
The patient cable can be cleaned with a damp cloth. Use lukewarm water and a non-abrasive liquid household cleaner (no abrasive, no alcohol content solution). Check the cable regularly for damages and/or bad electrical contact. We also advise that you keep an extra patient cable in stock.

6.4. Environment information

Your Sonopuls 492 contains materials which can be recycled and/or are noxious for the environment. At the end of the duration of life, specialised concerns can take apart the Sonopuls 492 and sort out the noxious materials and materials for recycling. By doing so you contribute to a better environment.

Please ensure that you are well informed of the local rules and regulations regarding to the removal of equipment and accessories.

7.1. Displays fail to light up

- Check if the mains adapter is connected to the apparatus and mains supply.

7.2. Error code

The apparatus has discovered a fault during or after the self test. The error code consists of a 3 digit number and appears on the current intensity display. Remove any applicators or cables from the output sockets and switch the apparatus off and on again. If the code re-appears, contact your supplier. The apparatus is probably defective.

7.3. Broken contact in the CC-mode

When contact is broken in the CC-mode, the equipment will indicate this with a beep-tone. In order to avoid an unpleasant sensation for the patient, when the treatment head or electrode is placed back onto the surface that is to be treated, the current will ramp down to 0. To continue the treatment, you will have to set the current again.

7.4. Insufficient or no output current

- Check the patient cable for breaks or poor contact.
- Ensure that the sponges are sufficiently wet.
- If necessary, use a salt solution.
- Clean the electrodes.
- Check for poor contact.

7.5. The contact control fails to operate

Check the contact control by placing the treatment head in a bowl of water. It may be that the contact control is working, but that the contact gel is inadequate. If several treatment heads are available, it is possible to determine whether the problem lies in the gel, the treatment head or the apparatus itself.

7.6. Front panel check

Switching the apparatus on with buttons [9] and [10] pressed will turn all display segments on, allowing you to check their operation. Pressing buttons and operating the regulators should result in a beep. You can only exit this mode by switching the apparatus off.

English

8.1. Specifications

Ultrasound

Frequency	:	1 and 3 MHz
Read out	:	intensity in W/cm² and power in W (SATP*)
Contact control level	:	65%
Timer	:	0 - 30 minutes, linked to the contact control

Ultrasound continuos
    Pulse frequency / duty cycle : 100 Hz / 100 %
    Intensity : 0 - 2 W/cm²
Ultrasound pulsed mode
    Pulse frequency / duty cycle : 100 Hz / 5, 10, 20, 50, 80 %
    Intensity : 0 - 3 W/cm², duty cycle 5, 10, 20, 50 %
     : 0 - 2.5 W/cm², duty cycle 80 %

Treatment heads

1 and 3 MHz, large transducer (standard) : Geometric surface 5.8 cm², ERA* 5 cm², BNR* max. 5, type collimating. Side panel radiation max. 10 mW/cm² (IEC requirement $\leq$ 100 mW/cm²)

1 and 3 MHz, small transducer (optional) : Geometric surface 1.15 cm², ERA* 0.8 cm², BNR* max. 5, type collimating. Side panel radiation max. 10 mW/cm² (IEC requirement $\leq$ 100 mW/cm²)

* SATP = Spatial Average Temporal Peak (average pulsed power)
* ERA = Effective Radiating Area, this is the effective radiating area of the treatment head.
* BNR = Beam Nonuniformity Ratio, indicates the ratio between the peaks and the average value of the intensity in the sound beam. A low BNR excludes high, unwanted energy concentrations.

ERA and **BNR** are measured confirm the FDA- method. All treatment heads have a visual contact control.

Electrotherapy general

Channels	:	2
Current characteristic	:	Constant Current (CC) or Constant Voltage (CV)
Setting resolution	:	0.2 mA
Timer	:	0 - 60 minutes
Polarity reversion direct currents	:	manual

The maximum intensity within the specification is achieved up to a load of 500 Ω (CC).

Symmetrical and asymmetrical biphasic Pulsed Current, TENS

Frequency	:	1 - 200 Hz
Phase duration (pulse width)	:	10 - 400 μs
Burst frequency	:	0 - 9 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 en 1/30/1/30 s
Surge pattern	:	Ramp up 0 - 9 s
		Hold time 1 - 60 s
		Ramp down 0 - 9 s
		Interval time 1 - 60 s
		Delay time 0.1 - 80 s
Intensity	:	0 - 140 mA.

In certain pulse width, frequency and spectrum combinations the setting range is reduced to 90-mA max. in order to meet the limit values of IEC 60601-2-10

ENRAF NONIUS

High voltage

Frequency	:	1- 200 Hz
Modulation frequency (spectrum)	:	0 - 90 %
Modulation time (spectrum)	:	1/1, 6/6, 12/12 en 1/30/1/30 s
Intensity	:	0 - 500 Volt
Alternating mode:		
Alternation time	:	5 tot 50 seconds
Ramp up and ramp down time	:	0.1 - 1 second
Non alternating mode:		
Surge pattern	:	As with TENS currents

Microcurrent

Current intensity	:	10 μA - 1 mA
Voltage range	:	200 V
Alternating mode:		
Frequency	:	0 - 1000 Hz
Alternation time	:	0.1 - 10 seconds (the alternation time is related to the pulse frequency)
Ramp up and ramp down	:	0.1 - 1 second
Non alternating mode:		
Frequency	:	0.1 - 1000 Hz
Surge pattern	:	As with TENS currents

Interrupted alternating current, Russian Stimulation

Carrier frequency	:	2 - 10 kHz
Burst-frequency	:	0 - 100 Hz
Burst / interval ratio	:	1:1, 1:2, 1:4 and 1:5
Surge pattern	:	As with TENS currents
Intensity	:	0 - 100 mA

Diadynamic current forms

Options	:	MF, DF, CP, LP and CPid
Intensity	:	0 - 70 mA
Surge pattern (MF and DF only)	:	As with TENS currents

Faradic currents

Options	:	2 - 5 current according to Träbert (default choice rectangular pulse)
Phase duration	:	0.02 - 1000 ms with rectangular pulsed current 0.1 - 1000 ms with triangular pulsed current
Phase interval	:	5 - 5000 ms
Surge pattern	:	As with TENS currents
Intensity	:	0 - 80 mA

Interrupted direct current

Frequency	:	8000 Hz
Duty cycle	:	95%
Intensity	:	0 - 40 mA

2-pole interferential current (premod)

Carrier wave	:	2 - 10 kHz
Beat frequency (AMF)	:	0 - 200 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 and 1/30/1/30 s
Surge pattern	:	As with TENS currents
Intensity	:	0 - 100 mA

4-pole interferential current (classical)

Carrier wave	:	2- 10 kHz
Beat frequency (AMF)	:	0 - 200 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 and 1/30/1/30 s
Surge pattern	:	Not adjustable
Intensity	:	0 - 100 mA
Balance setting	:	With central controller

Isoplanar vector

Carrier wave	:	2- 10 kHz
Beat frequency (AMF)	:	0 - 200 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 and 1/30/1/30 s
Surge pattern	:	Not adjustable
Intensity	:	0 - 100 mA

Dipole vector automatic

Carrier wave	:	2- 10 kHz
Beat frequency (AMF)	:	0 - 200 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 and 1/30/1/30 s
Surge pattern	:	Not adjustable
Intensity	:	0 - 100 mA
Rotation speed	:	adjustable from 1 to 10 seconds

Dipole vector manual

Carrier wave	:	2 - 10 kHz
Beat frequency (AMF)	:	0 - 200 Hz
Modulation frequency (spectrum)	:	0 - 180 Hz
Modulation time (spectrum)	:	1/1, 6/6, 12/12 and 1/30/1/30 s
Surge pattern	:	Not adjustable
Intensity	:	0 - 100 mA
Position	:	360°

Memory functions

Equipment setting 0	:	start-up setting.
Equipment settings	:	10, user programmable
User defined protocols	:	10
Pre-programmed protocols	:	50

8.2. Technical specifications

Mains adapter
Type mains adapter	:	ENA-1550
Mains voltage	:	100 - 240 Volt, +/- 10 %
Frequency	:	50 / 60 Hz
Output voltage	:	15 Volt
Max. Output current	:	3.3 Ampere

Apparatus
Medical device classification	:	IIb (according to Medical Device Directive (93/42/EEC)
Safety class	:	I, type BF, according to IEC 60601-1
Patient leakage current	:	Better than IEC requirement (IEC $\leq 100\,\mu A$)
Ditto, first fault condition	:	Better than IEC requirement (IEC $\leq 500\,\mu A$)
Safety tests	:	CE-MDD (TÜV Rheinland)
Dimensions	:	29 x 28 x 11 cm (w x d x h)
Weight	:	4 kg.

Environment conditions for transport and Storage
Environment temperature	:	-10° till +50° C
Relative humidity	:	10 till 100 %
Atmospheric pressure	:	500 till 1060 hPa

Environment conditions normal use
Environment temperature	:	10° till 40° C
Relative humidity	:	10 till 90 % (non condensing)
Atmospheric pressure	:	500 till1060 hPa

8.3. Classification

CE 0197

Medical class IIb
This equipment complies with all requirements of the Medical Device Directive (93/42/EEC).

International safety norm
The Sonopuls 492 complies to the international norm for medical electrical devices IEC 60601-1, including IEC 60601-2-5 (Ultrasound) and IEC 60601-2-10 (Electrical nerve stimulators).

I The equipment has a safety earth (ground) connection, and must be connected to an earthed (grounded) wall socket.

type BF, the equipment has a floating patient circuit.

Technical modifications reserved

For the ordering data of the Sonopuls 492, standard accessories and additional accessories refer to the Catalogue for Physiotherapy and leaflet.