

# SAPHYR

## The 4th generation of BTE

Unique-Precious-Essential



neurelec  
SEE • FEEL • HEAR • LIVE

The logo for Saphyr, featuring a stylized blue triangle above the lowercase letters 'saphyr' in a blue sans-serif font.

## THE RESULT OF TEAMWORK AND YEARS OF EXPERIENCE

- New dual DSP electronic platform
- New signal processing: CRYSTALIS with improved audiometric results (large IDR)
- Ultra-Low Noise Auxiliary connection and integrated Telecoil
- Almost 10% lighter while increasing robustness and reliability
- New packaging and accessories
- Downward compatibility with previous implant generations



UNIQUE-PRECIOUS-ESSENTIAL

## THE PERFORMANT TECHNOLOGY



- 1 MICROPHONES**  
2 omnidirectionnal
- 2 FITTINGS CONTROL**  
Gain control  
Denoising control  
Switch on/off
- 3 PROGRAM SELECTOR**  
4 independant programs
- 4 ANTENNA LEAD**  
Robust connection  
3 colours available
- 5 ANTENNA**  
3 colours available
- 6 MAGNET**  
4 standard strenghts available



**7** ADJUSTABLE HOOK  
2 models available, adaptable to the ear

**8** AUXILIARY CONNECTION  
Large compatibility with accessories



**9** BATTERIES  
2 zinc air Batteries for 3/4 days  
Possibility of rechargeable P675 batteries

**10** PARENTAL CONTROL  
Audio output with earphones for microphone testing  
LED control (power on and low battery indicator)

### LIGHT LIKE A BUTTERFLY...

- Weight: 7,7g (11,3g with 2 batteries)
- A discret ergonomic friendly design which respects the natural shape of the ear
- A design already approved by patients
- A bio-compatible material especially developed for medical devices (ISO 10993)



### ... BUT ROBUST AS A SAPPHIRE

- Simplicity of the system for a reliability improved
- Solder Bump Technology assembly for optimized resistance to shocks
- Protection against humidity increased by the tropicalisation process
- *Major actions* to enhance reliability: solid strengthened connections, robust electronic boards, micro-screws integration, new microphone encapsulation, modular conception



## A LUXUOUS PACKAGING FOR A JEWEL OF TECHNOLOGY



- Multilingual packaging: 14 languages!!!
- New accessories that matches better the patients needs
- New manuals to provide all the necessary information

S E E • F E E L • H E A R • L I V E



S E E • F E E L • H E A R • L I V E

*Thank You!*



## Saphyr प्रोसेसर का परिचय और उसका उपयोग

### 1. प्रोसेसर

- **ध्वनि के नियंत्रण करने के लिए**

इसका उपयोग ध्वनि को नियंत्रित करने के लिए किया जाता है! आमतौर पर इसकी ध्वनि 1-2 पर सेट की जाती है और जरूरत के हिसाब से इसकी ध्वनि को कम या ज्यादा किया जा सकता है!

- **प्रोग्राम कंट्रोल**

कार्यक्रम स्मृति, चिकित्सक की दिशा के अनुसार P1 से P2, P3 या P4 में बदलता है!

- **एक्ससैसरी पोर्ट**

इसका उपयोग यात्रा / ड्राइविंग करते समय हाथ मुक्त सेट (Hand free) लगाने के लिए किया जाता है और इससे फोन या आईपॉड के गाने भी सुन सकते हैं!

- **लेड लाइट**

हरी बत्ती की निमिष प्रोसेसर चालू है इसका सूचित करता है

लाल बत्ती की निमिष प्रोसेसर बंद या बैटरी कम है इसका सूचित करता है

- **हुक**

कान के पिछे प्रोसेसर लगे रहने में मदद करता है! हुक को कान के आकार के हिसाब से बड़े या छोटे आकार में बदला जा सकता है! यह एअरमोल्ड्स के साथ सलंगन (attach) किया जा सकता है! हुक बदलने के लिए उसको घुमाइये और ऊपर खिंचियें!



## 2. ऐन्टेना

प्रोसेसर से सिर में बिठाया इम्प्लांट तक ध्वनि संकेत संचारित करने में मदद करता है



## 3. ऐन्टेना केबल

यह प्रोसेसर और ऐन्टेना को जोड़ता है



## 4. मैग्नेट

5. यह इम्प्लांट पर ऐन्टेना जोड़ने में मदद करता है! इसे हटा दिया और विभिन्न बल के मैग्नेट लोह चुम्बक के साथ बदला जा सकता है जो एक पेंच की तरह है!



## 6. बैटरी

दो बैटरीज प्रोसेसर के अन्दर डालना है! केवल इम्प्लांट 675 बैटरीज लगभग 3 दिनों के लिए चलता है! अन्य 675 बैटरीज 24 घंटे से अधिक के लिए काम नहीं कर सकते!



## 7. द्राइंग किट

यह प्रोसेसर सुखाने में मदद करता है! चालू करने के लिए मदद चार्जर लगाना है! जब चालू होगा हरी बत्ती देखा जाता है! बैटरी को बाहर निकाल ले! खुली बैटरी और प्रोसेसर को डिब्बे के साथ सुखाने के बॉक्स के अंदर रखे! सुखाने के समय बॉक्स में पीला सिलिकॉन क्रिस्टल्स रखना है!



## 8. क्लिप ऑन कवर

क्लिप ऑन कवर में कवर प्रोसेसर को धूल, मिट्टी, पानी आदि से बचाता है तथा क्लिप प्रोसेसर को गिरने से बचाता है!



## ALPS – Digisonic CI

प्रोसेसर का उपयोग करते समय निम्न बातों का ध्यान रखे:

- प्रतिदिन प्रोसेसर की बैटरी की जाँच टैस्टर पर करे!
- टैस्टर पर बैटरी लगाने के बाद उसमें हरी बत्ती जलती दिखे तो इसका मतलब आपके प्रोसेसर की बैटरी सही काम कर रही है, अगर लाल बत्ती जले या कोई भी बत्ती ना जले तो इसका मतलब आपके प्रोसेसर की बैटरी खत्म हो गई है!
- नई बैटरी प्रोसेसर में डालकर पुनः जाँच करे!
- नई बैटरी लगाने के बाद भी यदि प्रोसेसर काम ना करे तो शॉट केबल को बदल कर देखे!
- ऐन्टेना केबल बदलने के बाद भी प्रोसेसर काम ना करे तो प्रोसेसर की जाँच अपने सेंटर पर कराए!

### **सावधानियाँ / Precaution:-**

- स्नान करने से पहले प्रोसेसर को उतार ले तथा प्रोसेसर के अन्दर से बैटरी को निकाल कर अलग रख दे!
- प्रोसेसर को कभी गिरने ना दे!
- ध्यान रखे की प्रोसेसर को कभी गिला ना होने दे!
- सोने से पहले प्रोसेसर को उतार कर ड्राइंग कीट में रखे!



## ALPS INTERNATIONAL PVT. LTD

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☎ (91-11) 417 55191 FAX : (91-11) 2686 2940

Email : sales@alps.in

### Warranty Details for DigisonicSP Cochlear Implant

The internal implant – warranty 10 years

The Behind The Ear Processor warranty for 3 years from date of switch on - against manufacturing defects.

#### Accessories:

- Antenna Cable: 3 months
- Drying Kit (if applicable), Antenna, Magnet, Hook and the tester : 1 year
- No warranty on batteries, clip on cover, support loop, case, transport pack etc.

The warranty applicable is as per standard company policy. Defects due to misuse or physical damage will not be covered under warranty. Please refer to our standard warranty document for complete details.

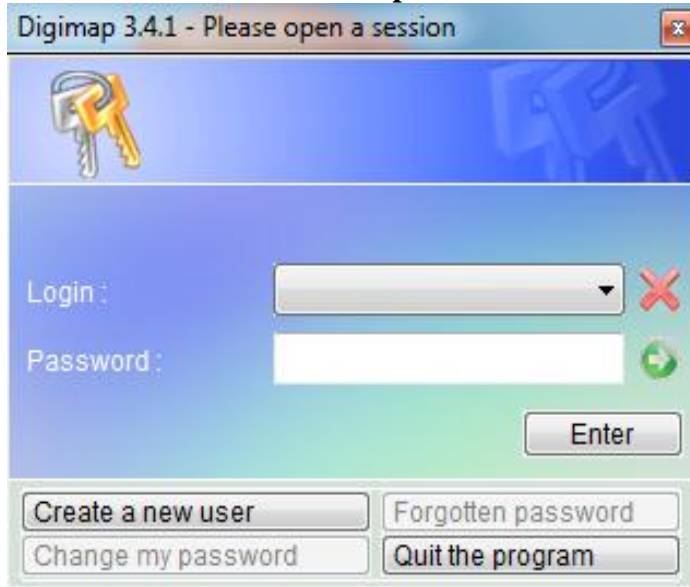
For Alps International Pvt Ltd

  
Sales Manager

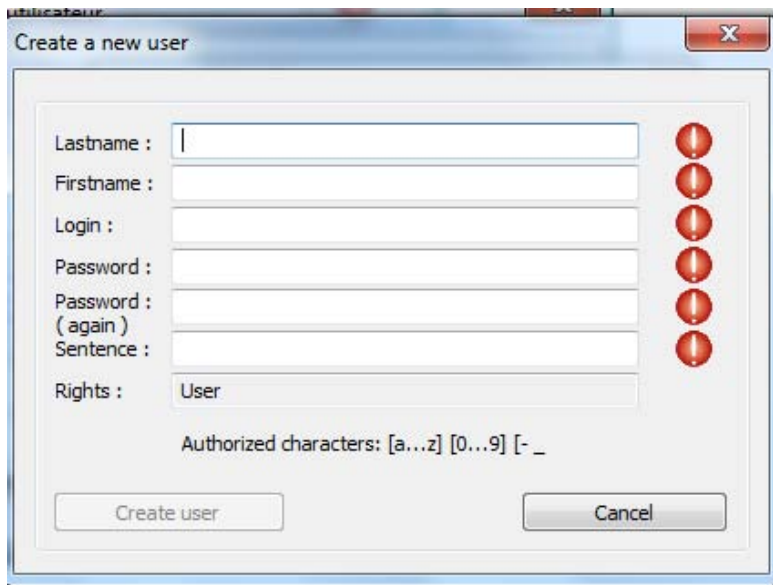
# Fitting Guide for the implant Digisonic SP with a Saphyr processor

## 1 step :

For the first use a user should be created . Follow the instructions for creating a new user. Define user name and password.



The screenshot shows the 'Digimap 3.4.1 - Please open a session' window. It features a blue header with a key icon. Below the header, there are two input fields: 'Login :' with a dropdown arrow and a red 'X' icon, and 'Password :' with a green circular refresh icon. An 'Enter' button is positioned below the password field. At the bottom, there are four buttons: 'Create a new user', 'Forgotten password', 'Change my password', and 'Quit the program'.



The screenshot shows the 'Create a new user' dialog box. It contains several input fields: 'Lastname :', 'Firstname :', 'Login :', 'Password :', 'Password : (again)', and 'Sentence :'. To the right of these fields is a vertical column of six red circular indicators. Below the input fields, there is a 'Rights :' field with 'User' selected. At the bottom, there are two buttons: 'Create user' and 'Cancel'. Below the buttons, the text 'Authorized characters: [a...z] [0...9] [- \_]' is displayed.

Complete all lines and finish «Create user »

Create a new user

Lastname : qwertzui

Firstname : zui

Login : qz

Password : ●●●●

Password : ●●●●  
( again )

Sentence : name of ....

Rights : User

Authorized characters: [a...z] [0...9] [- \_]

Create user Cancel

Be careful

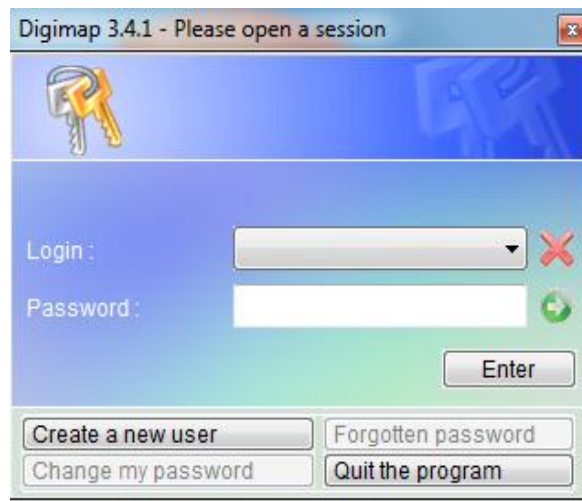
⚠ Please check and confirm that you want to create the following user:  
Please check your password because if prohibited characters are entered, they could be converted

Login : qz  
Password : pass  
Lastname : qwertzui  
Firstname : zui  
Rights : user

Ja Nein

**Verify and confirm with « Yes »**

**Close the window and click the digimap icon. The login window will appear.**



**The software will open like this (you can set up the language into English, French or Italian in the configuration mode.)**



### **First fitting**

**Connect the CS45 cable (with 5 point connection) specifically for Saphyr (and Digi SPK) with the interface Digimap USB.**

#### **Connection**

- **Processor light flashes (but the wheel of the processor has to be on volume 1, 2 or 3). At 0 the device is off.**
- **No battery in the battery compartment.**
- **Watch the green light of the interface**

**Select Processor in the menu**

- Click Connection or as a short cut F12
- Click Patients and select on the drop down menu “new patient” . The new identity card for the patient will show up in a new window.

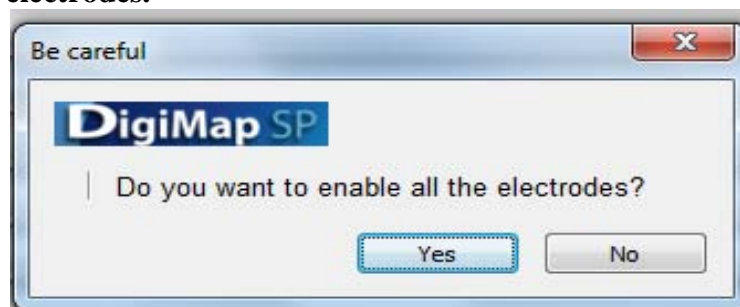
- Complete
  - Name
  - First Name
  - The processor connected and serial number is automatically known and shown
  - Complete the intervention date, the ear of implant, the type of implant with serial number.
    - Make sure the Serial number follow this example with a capital letter 00K0000
    - Valider



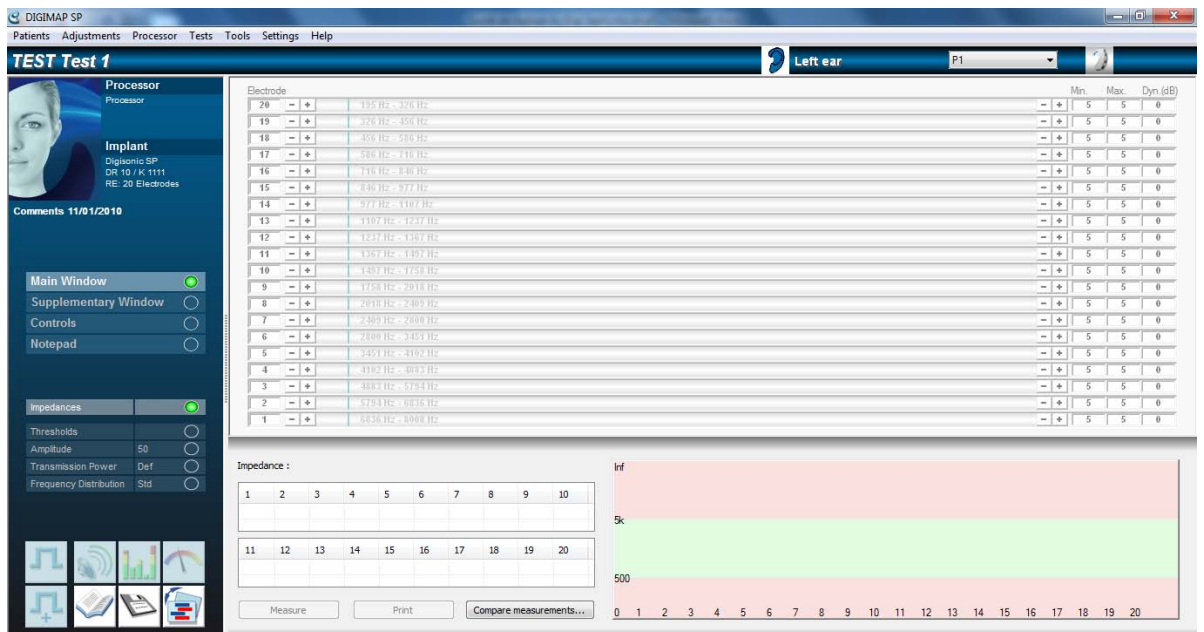
- Click final accept
- The fitting window appears



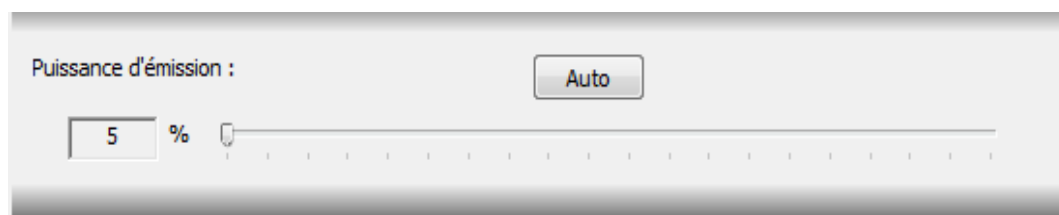
- Activer all electrodes. It works with double click on the single electrode or by choosing the CTRL E , in order activate all electrodes.



- Click yes to confirm
- With the Saphyr you can measure the impedance. Click the option « Impedances » and measure



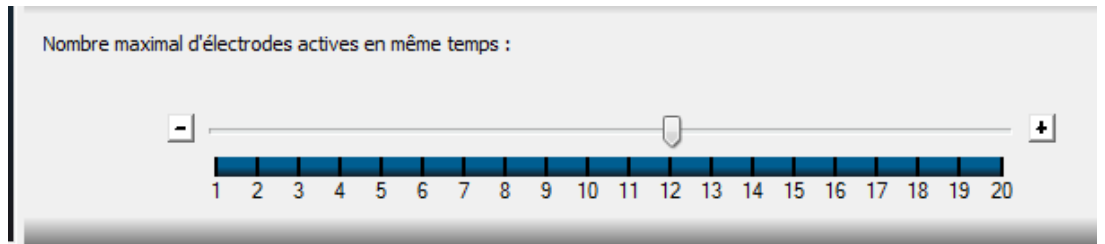
- You can manually adjust the «transmission power » to define the amount of energy that is required to transmit the energy through the skin. (This test is possible as soon as all electrodes are activated)
- Click « auto »
- In case of switching from a Saphyr 2 turn antenna to a Saphyr 3 turn antenna it is required to re-test one time the transmission power.



- 5% of transmission power is a standard value. 15% represents a higher power consumption and should be avoid

### Parameter setting at the activation fitting :

- Select the frame “supplementary window”
  - Stimulation : The standard default setting of stimulating electrodes is 10. It can be increased to 12 to 14



○

●

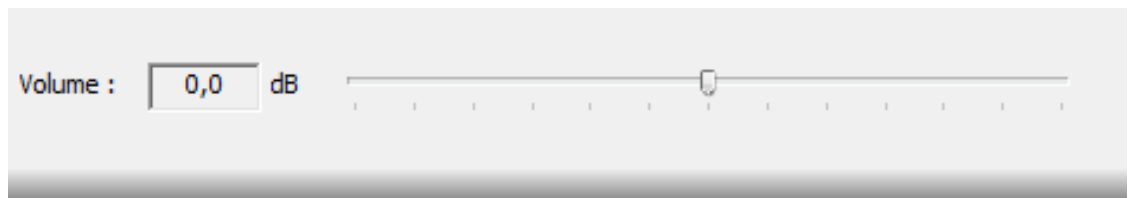
○ **Verify that the gain is flat at 0**

●



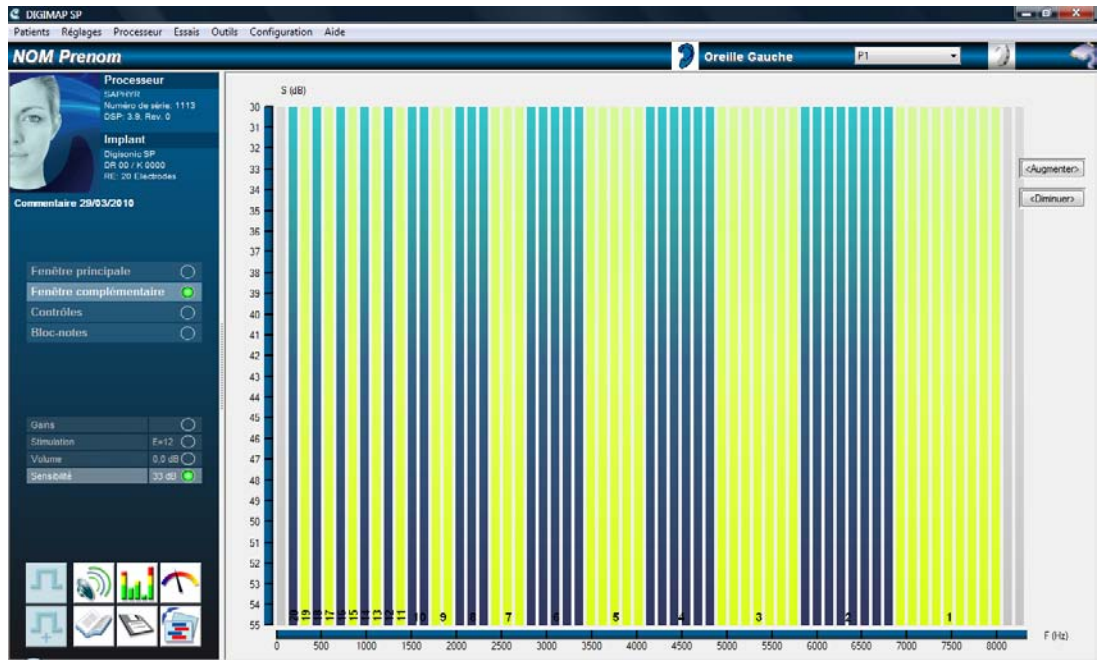
○

○ **Verify that the volume is at 0**



○

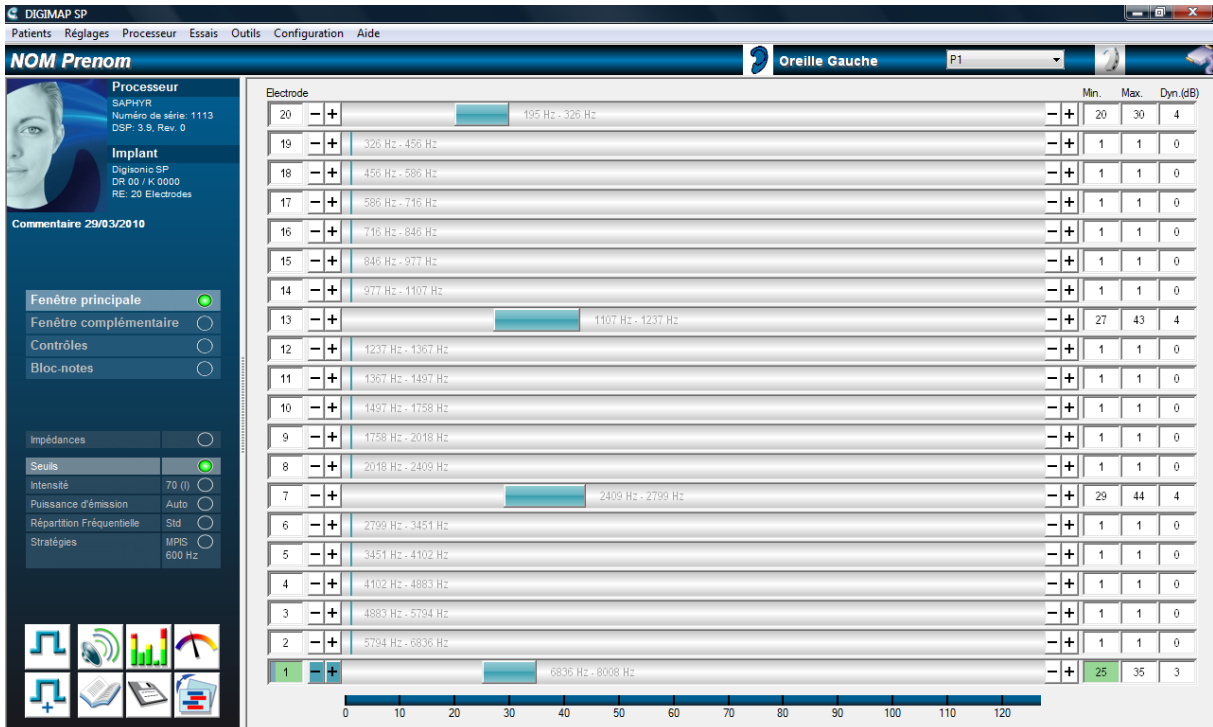
○ **Denoising should be at the highest level of the window screen.**



**The fitting :**

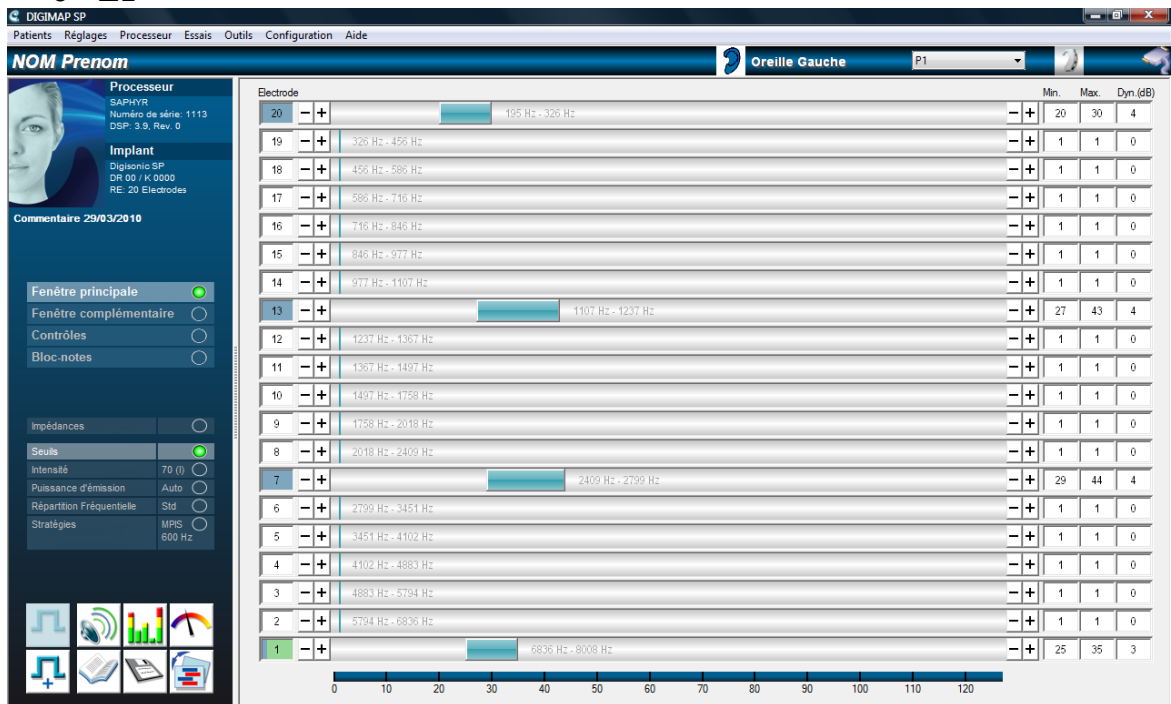
**Go to the main window :**

- **Test the T and C levels and benefit from the interpolation function**
  - Interpolation of the electrical threshold levels:
  - Test the C levels and the T levels of 4 Electrodes

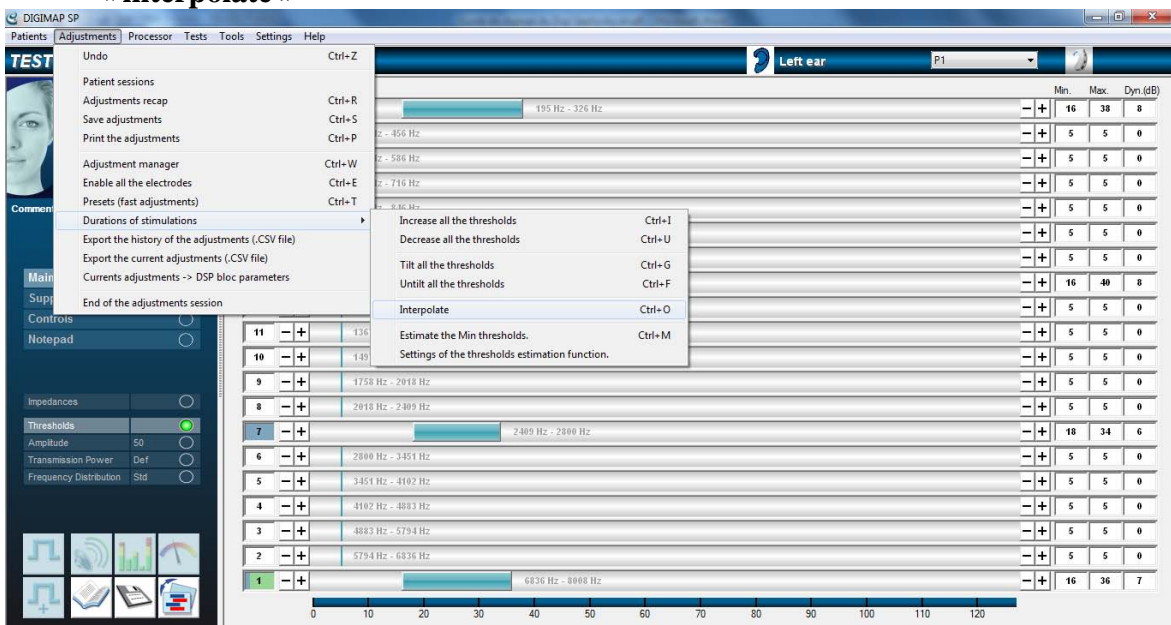


- Select 4 active electrodes with the help of the combination Ctrl+click left on the 4 electrodes chosen

- (Always include the most basal and the most apical electrode into the interpolation)
- Select the electrodes which are homogen over the complete range of all electrodes
- Example over the whole range of 20 active electrodes :
- **E20**
- **E13**
- **E7**
- **E1**



- After this click on «adjustments», «duraciont of stimulation», « interpolate »



The following window shows up

DIGIMAP SP

Patients Adjustments Processor Tests Tools Settings Help

**TEST Test 1** Left ear P1

Processor  
Processor

Implant  
Digisonic SP  
DR 10 / K 1111  
RE: 20 Electrodes

Comments 11/01/2010

Main Window   
Supplementary Window   
Controls   
Notepad

Impedances   
Thresholds   
Amplitude 50   
Transmission Power Def   
Frequency Distribution Std

Electrode	Min.	Max.	Dyn.(dB)	
20	195 Hz - 326 Hz	16	38	8
19	326 Hz - 456 Hz	5	5	0
18	456 Hz - 586 Hz	5	5	0
17	586 Hz - 716 Hz	5	5	0
16	716 Hz - 846 Hz	5	5	0
15	846 Hz - 977 Hz	5	5	0
14	977 Hz - 1107 Hz	5	5	0
13	1107 Hz - 1237 Hz	5	5	0
12	1237 Hz - 1367 Hz	5	5	0
11	1367 Hz - 1497 Hz	5	5	0
10	1497 Hz - 1758 Hz	5	5	0
9	1758 Hz - 2018 Hz	5	5	0
8	2018 Hz - 2409 Hz	5	5	0
7	2409 Hz - 2799 Hz	18	34	6
6	2799 Hz - 3451 Hz	5	5	0
5	3451 Hz - 4102 Hz	5	5	0
4	4102 Hz - 4883 Hz	5	5	0
3	4883 Hz - 5794 Hz	5	5	0
2	5794 Hz - 6836 Hz	5	5	0
1	6836 Hz - 8008 Hz	16	36	7

Be careful  
DigiMap SP  
Be careful, this action will modify the length of the stimulations of several electrodes.  
Do you really want to interpolate?

Yes No

○ Click yes ‘

DIGIMAP SP

Patients Réglages Processeur Essais Outils Configuration Aide

**NOM Prenom** Oreille Gauche P1

Processeur  
SAPHYR  
Numéro de série: 1113  
DSP: 3.9, Rev. 0

Implant  
Digisonic SP  
DR 00 / K 0000  
RE: 20 Electrodes

Commentaire 29/03/2010

Fenêtre principale   
Fenêtre complémentaire   
Contrôles   
Bloc-notes

Impédances   
Seuils   
Intensité 70 (I)   
Puissance d'émission Auto   
Répartition Fréquentielle Std   
Stratégies MPIS 600 Hz

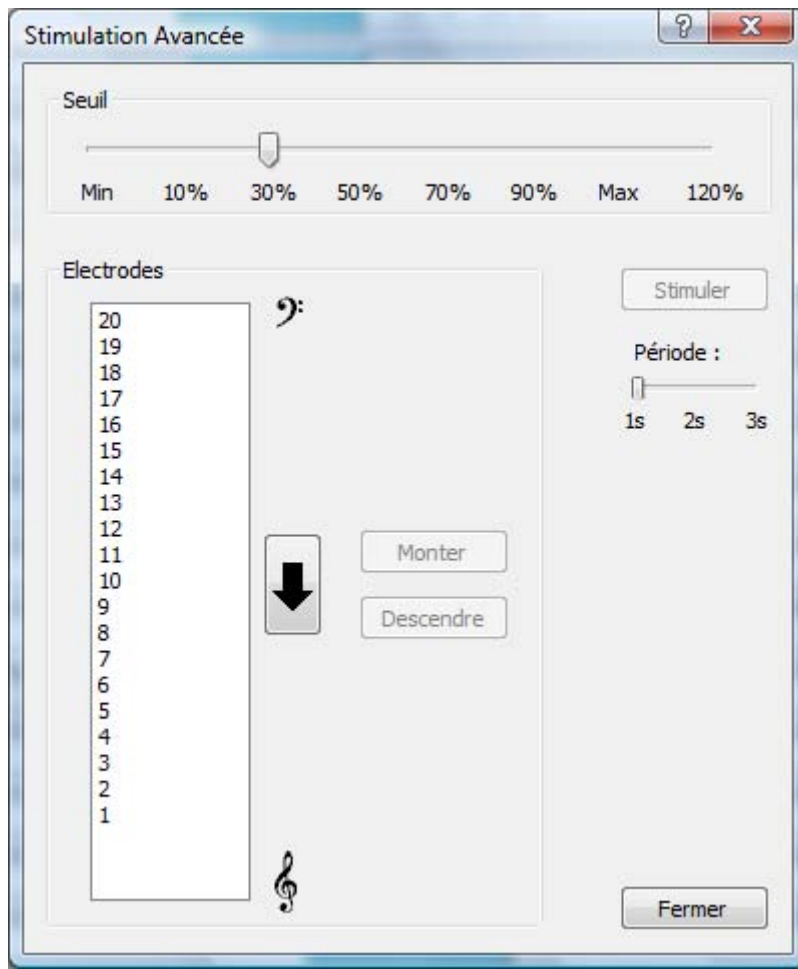
Electrode	Min.	Max.	Dyn.(dB)	
20	195 Hz - 326 Hz	27	44	4
19	326 Hz - 456 Hz	28	44,50	4
18	456 Hz - 586 Hz	29	45	4
17	586 Hz - 716 Hz	30	46,50	4
16	716 Hz - 846 Hz	31	48	4
15	846 Hz - 977 Hz	32,50	49,50	4
14	977 Hz - 1107 Hz	33,50	51	4
13	1107 Hz - 1237 Hz	35	53	4
12	1237 Hz - 1367 Hz	36	54,50	4
11	1367 Hz - 1497 Hz	37,50	56,50	4
10	1497 Hz - 1758 Hz	38,50	58	4
9	1758 Hz - 2018 Hz	39	59	4
8	2018 Hz - 2409 Hz	39,50	59,50	4
7	2409 Hz - 2799 Hz	40	60	4
6	2799 Hz - 3451 Hz	40	60	4
5	3451 Hz - 4102 Hz	39,50	59	3
4	4102 Hz - 4883 Hz	39	57,50	3
3	4883 Hz - 5794 Hz	38	55	3
2	5794 Hz - 6836 Hz	36	52	3
1	6836 Hz - 8008 Hz	34	48	3

○ Example with only 15 active electrodes in total select the following electrodes:

- E20
- E15
- E9
- E5

○ Always test with advanced stimulation (from 50 to 120%) before going on life mode

- To perform this, use the short cut  or F3 or in Test menu select « stimulation » and « advanced stimulation ».
- The advanced stimulation window appears:



- With the Saphyr it is possible to define the duration of the stimulation for each electrode between 1, 2, or 3 seconds.

### List of short cuts and manipulation for checking the T and C levels

Action	Manipulation on keyboard	Using the mouse
Select several electrodes (Seperat from each other or next to each other) and stimulate these electrodes	Click SHIFT or CTRL and continue to select the electrodes to highlight them followed by stimulating by pressing F2	Click SHIFT or CTRL and continue to select the electrodes to highlight them followed by stimulating the short cut in the management tool bar with Stimualtion.
Increase/ decrease the thresholds	Use the arrows right and left	Click on the bottions indicating + and – represented on the right and left of the electrodes
Switch between the	Use « Enter » for back and	Clcik on the bottions + and –

thresholds Min/Max	force or « TAB » for switching from min ot max.	corresponding to the threshold if interest
Start /Stop the stimulation	Use the short cut F2	Click on stimulation short cut in the management bar

- **In case of a very young child**
  - **Draw a first MAP of the fitting with the following parameters (usually the patient does not respond to this setting of the T and C**



Figure 1: first MAP

- **Advanced Stimulation**
  - The minimums are balanced from minimum
  - In case of no reaction double click on Min (red circle) and increase by steps of 2 until a reaction is recognized. Test via advanced stimulation
  - In case of reaction reduce by steps of 3 all T levels
  - Adjust the C levels according to the responses you see on the patient
- **Test life mode and the voice (test sounds and phonems)**

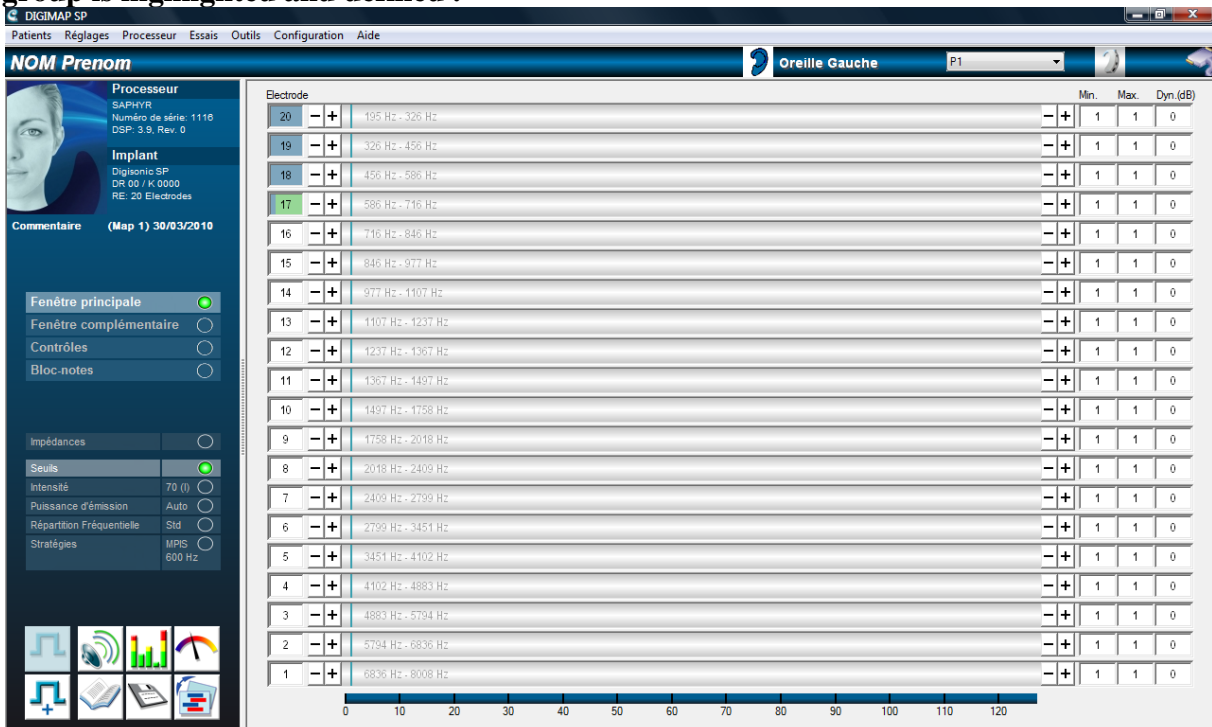




Figure 2: MAP after fitting at a first fitting

- **In case of a child trained and adults**
  - **Check for the Max and Min using the group stimulation in the following way :**
    - **E20-E16**
    - **E15-E10**
    - **E9-E4**
    - **E3-E1**
- **Select one group of electrodes**

**Click on one electrode and then click ctrl and click on the following electrodes until the group is highlighted and defined .**



After this click on Max or Min in order to manipulate and move the C and T of the group. Here the Max

Here are the Min

Repeat the procedure on several groups of electrodes (it is required to have 4 groups in order to use the interpolation functionii).



Figure 3: MAP defined with 4 levels of T and C

- Select the following electrodes with the help of click on Ctrl+click on the left hand shown electrodes
  - E20
  - E13
  - E7
  - E1
- Use the function of interpolation with click on Ctrl+O



Figure 4: MAP after interpolation



- Check the thresholds of the C with advanced stimulator
- Perform an audiogram and verify the thresholds

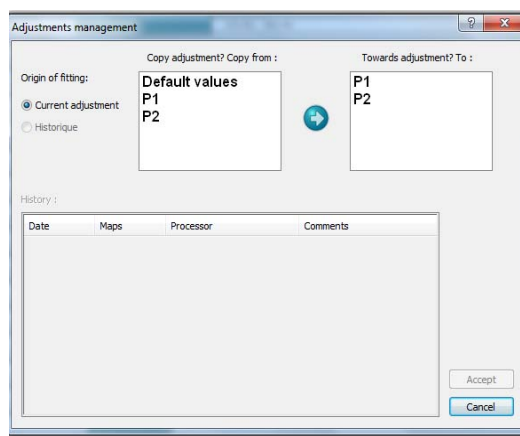
## Note :

If it is not possible to define the thresholds it is possible to use the function «Estimate the minimum of the patient». It is found under Adjustments and Duration of stimulation followed by « Estimate the Min » or by using the short cut with Ctrl+M.

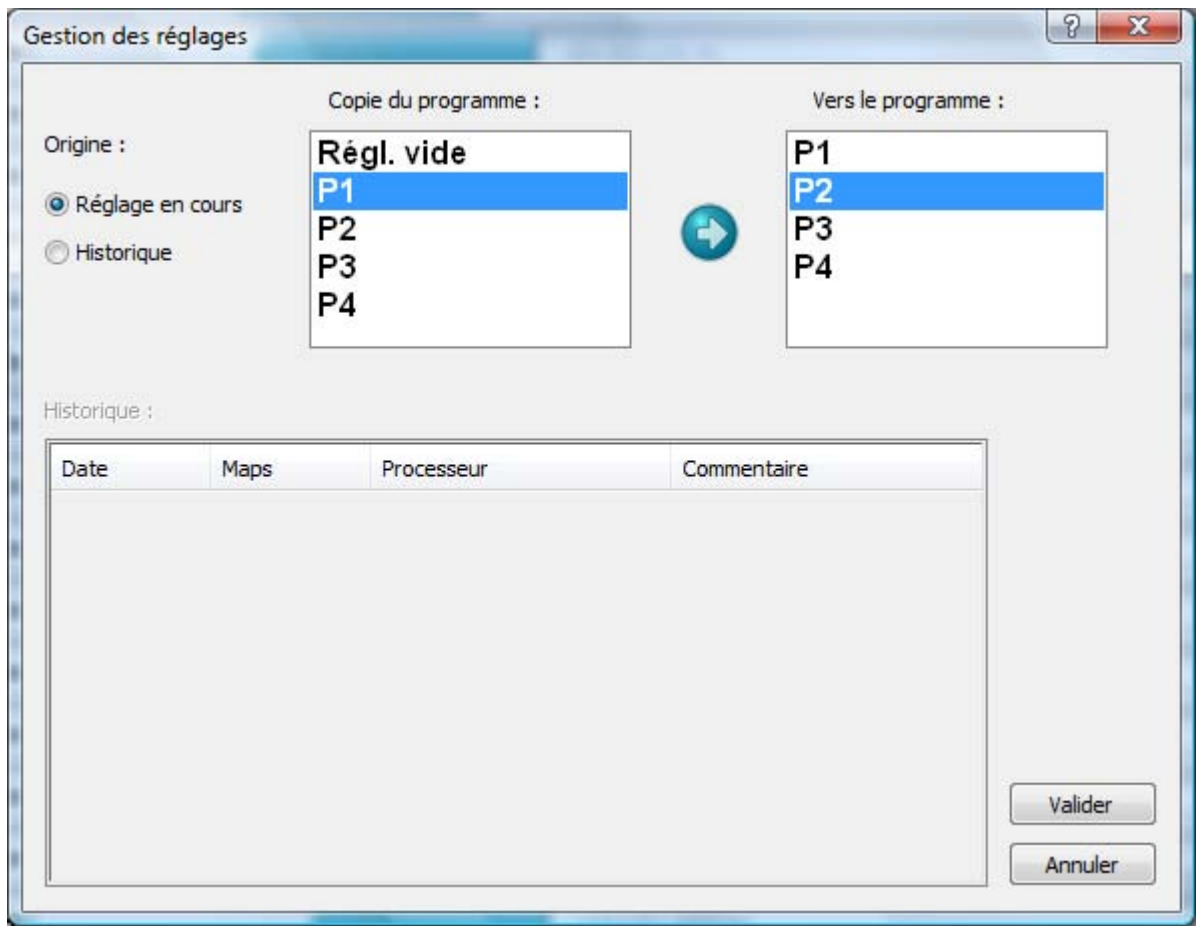
- **Voice test**
  - Test the voice
  - In the case of a too high stimulation and uncomfortable loud voice for the patient
    - Lower the C levels one step
  - In the case of a too low stimulation and low voice
    - Increase the C levels one time
  
- **Go to the window CONTROL**
  - Verify that the options for the patient are met and the manipulation is set to the defined values.

**The fitting in P1 is done**

-  **Save the fitting** by a click to the icon of the disc in the menu of short cuts
  
-  **Click on the icon « Adjustment Management » to copy this program to another program.**
- **Copy P1 into P2, P3 and P4**



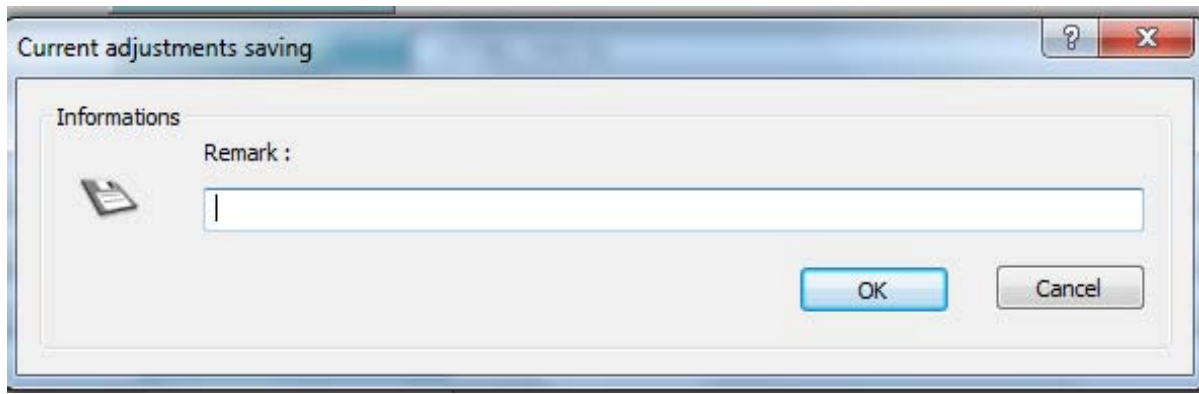
**Example for a Digi SP with only 2 independent programs**



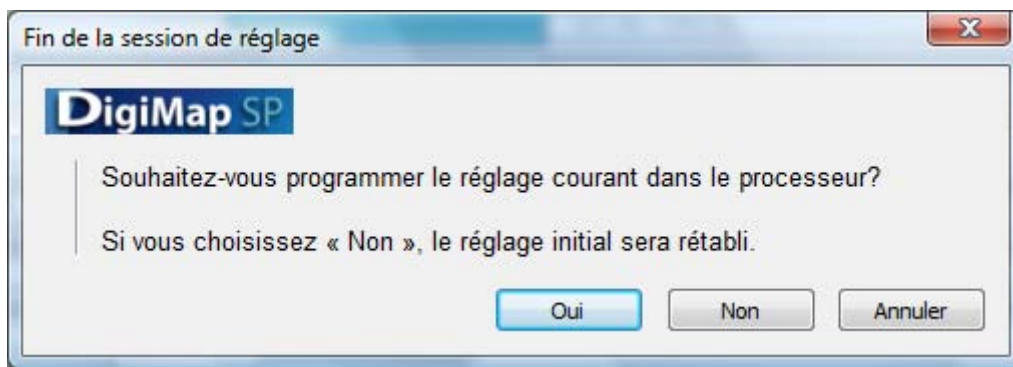
- 
- **Change the fitting in P2, P3, P4 to a higher or a lower setting according to the intension of fitting.**
- **Click on the Adjustment menu on « end of adjustment setting »**



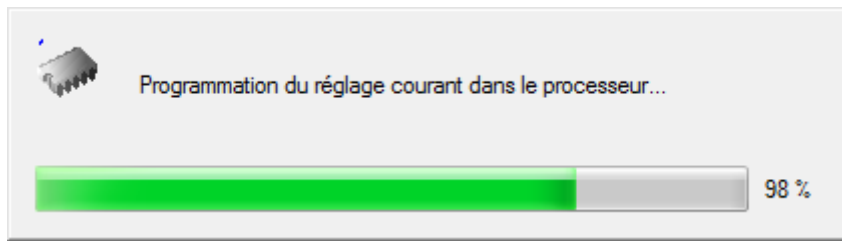
**Click on YES to save this fitting and write it into the processor**



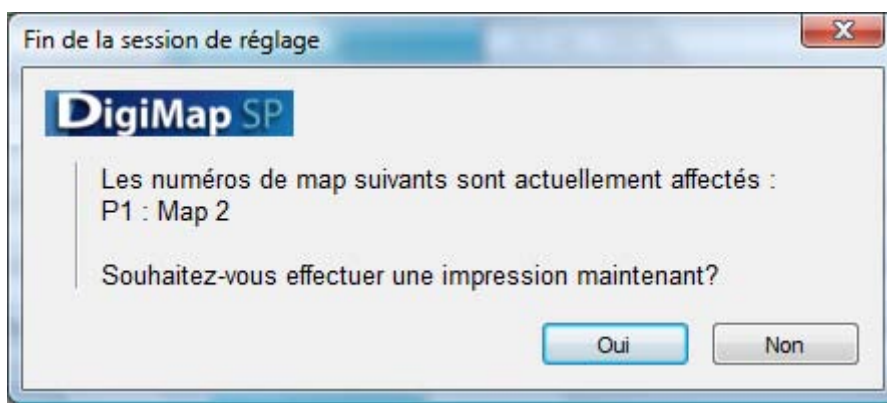
**Name the fitting on the window showing up to leave comments**  
**Click on « ok »**



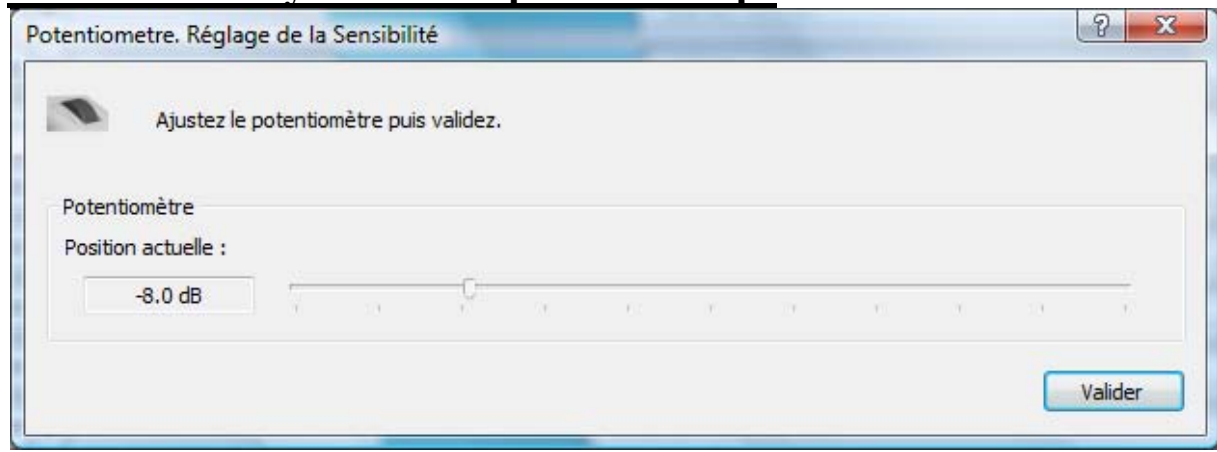
**Click on Yes if you want to get the fitting written into the processor.**



**The fitting gets recorded**



**Click on Yes if you want to print the maps**



**Adjust the potentiometer to the patient needs**  
**Validate**

# DigiMap SP

Version 3.4.3

User's Manual



# Table of Contents

<b>I)</b>	<b>INFORMATION ABOUT THE DIGIMAP SP 3.4.3 SOFTWARE</b>	<b>8</b>
	<b>A. Logging in as a user</b>	<b>8</b>
	<b>B. Description of the fittings window</b>	<b>9</b>
	1) Menu/information bars	9
	2) Functions	10
	2.1) <i>System identification</i>	10
	2.2) <i>Comments</i>	10
	2.3) <i>Management of parameters</i>	10
	2.4) <i>Shortcuts</i>	11
	3) Fittings	12
	<b>C. Description of menus</b>	<b>12</b>
	1) Patients Menu	12
	1.1) <i>New patient</i>	13
	a) Required	13
	b) Complementary	14
	c) Medical	15
	1.2) <i>Open</i>	15
	a) Local patient file	15
	b) Local patient file for the opposite side	15
	c) Saphyr® demo file	16
	1.3) <i>Identity card</i>	16
	1.4) <i>Importing a fitting</i>	16
	1.5) <i>Export a patient file</i>	16
	1.6) <i>Email a patient file</i>	17
	2) Fittings menu	17
	2.1) <i>Cancel the change</i>	17
	2.2) <i>Patient sessions – Map numbering</i>	17
	2.3) <i>Fittings recap</i>	19
	2.4) <i>Save fittings</i>	19
	2.5) <i>Print the fitting</i>	20
	2.6) <i>Fitting management</i>	20
	2.7) <i>Enable all electrodes</i>	20
	2.8) <i>Presets (fast fittings)</i>	20
	2.9) <i>Duration of stimulation</i>	21
	a) Increase/Decrease all thresholds	21
	b) Tilt +/- function for all thresholds	21
	c) Interpolate	22
	d) Estimate Min. thresholds	23
	2.10) <i>End fitting session</i>	24
	3) Processor Menu	25
	3.1) <i>Reinitialize the processor</i>	25
	3.2) <i>Update the processor</i>	25
	4) Tests Menu	25
	4.1) <i>Stimulation</i>	26
	a) Stimul<ation	26
	b) Advanced stimulation	26
	c) Stimulate a group of electrodes	26
	4.2) <i>Talk over test – Advanced talk over</i>	27
	4.3) <i>Measurements</i>	28
	a) Digiscope	28
	b) Vu-meter	29
	5) Tools Menu	29
	5.1) <i>Files Tools</i>	29
	a) Merge files	29
	b) Automatically rename files	31
	c) Find duplicated files	32

6) Settings Menu	32
6.1) <i>Stimulation</i>	32
6.2) <i>Ports</i>	33
6.3) <i>Files</i>	33
6.4) <i>Internet</i>	34
7) Help Menu	34
<b>II. FITTING PROCEDURE</b>	<b>35</b>
<b>A. Connection</b>	<b>35</b>
1) Unprogrammed processor	36
1.1) <i>The patient file not already saved in the computer (first fitting)</i>	36
1.2) <i>The patient file is saved in the computer (maintenance or pre-fitting)</i>	36
2) Processor that is already programmed	36
2.1) <i>Patient file not saved in the computer (new PC or change of center)</i>	36
2.2) <i>Patient file saved in the computer (standard fitting)</i>	37
<b>B. Reprogramming</b>	<b>37</b>
<b>C. Fitting parameters</b>	<b>37</b>
1) Main window	37
1.1) <i>Impedances</i>	37
1.2) <i>Thresholds</i>	38
a) Procedure	38
b) Suggestions for use	39
1.3) <i>Intensity</i>	43
a) Procedure	43
b) Suggestions for use	43
1.4) <i>Transmission power</i>	43
a) Procedure	44
b) Suggestions for use	44
1.5) <i>Frequency distribution</i>	44
a) Procedure	45
b) Suggestions for use	46
1.6) <i>Programming strategies</i>	47
a) Procedure	47
b) Suggestions for use	47
2) Supplementary window	47
2.1) <i>Gains</i>	47
a) Procedure	48
b) Suggestions for use	48
2.2) <i>Volume</i>	49
a) Procedure	49
b) Suggestions for use	49
2.3) <i>Denoising</i>	49
a) Procedure	50
b) Suggestions for use	50
2.4) <i>Stimulation</i>	50
a) Procedure	51
b) Suggestions for use	51
3) Controls	51
3.1) <i>Button control</i>	51
a) Program selector	52
b) LED	52
c) Auditory feedback	52
d) Potentiometer	52
3.2) <i>Microphones</i>	53
a) Procedure	54
b) Suggestions for use	54
3.3) <i>Auxiliary input</i>	54
a) FM system and Auxiliary input	54
b) Telecoil	55
<b>D. Other program</b>	<b>55</b>

<b>E. End fitting session</b>	56
1) Save in the patient file	56
2) Save to the storage media	56
3) Programming the processor	56

### **III. APPENDICES** 58

#### **B. Setting the DIGI SP'K processor** (except Digi SP'K cx)

- 1) Connection
- 2) Fitting parameters
  - 2.1) *Main Window*
    - a) Impedances
    - b) Thresholds
  - 2.2) *Supplementary window*
    - a) Stimulation
    - b) Volume
    - c) Gains
    - d) Denoising
  - 2.3) *Controls*
- 3) Other program
- 4) End fitting session

## I) INFORMATION ABOUT THE DIGIMAP SP 3.4.3 SOFTWARE

*Important:* This section of the document presents the various menus and tools that are available when using a latest generation Saphyr® SP processor. Differences specific to the other types of processors (Saphyr® CX, Zebra®, Digi SP'K, Digi SP, Digisonic® BTE and Digisonic® BW) will be highlighted when necessary. You can access user guidance for all processors via the Help section in the software.

### A. Logging in as a user

Once the software has been installed, you will need to log in as a User. Each user will have his/her own user name and password.

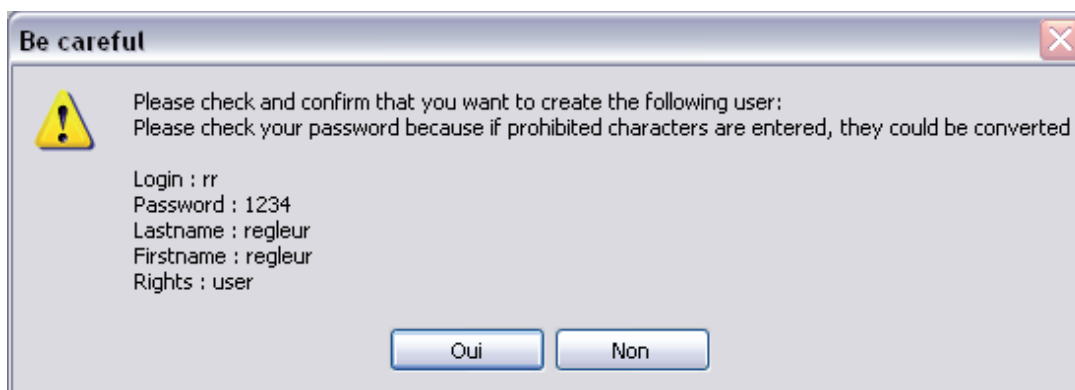
When using the Digimap SP software for the first time, click “Create a new user” to create your user account.



A window will open to guide you through entering the required information. All fields are necessary. Once the form is completed, click “Create the user”.



A window will open to validate your account information. To create the validated account click “Yes”.



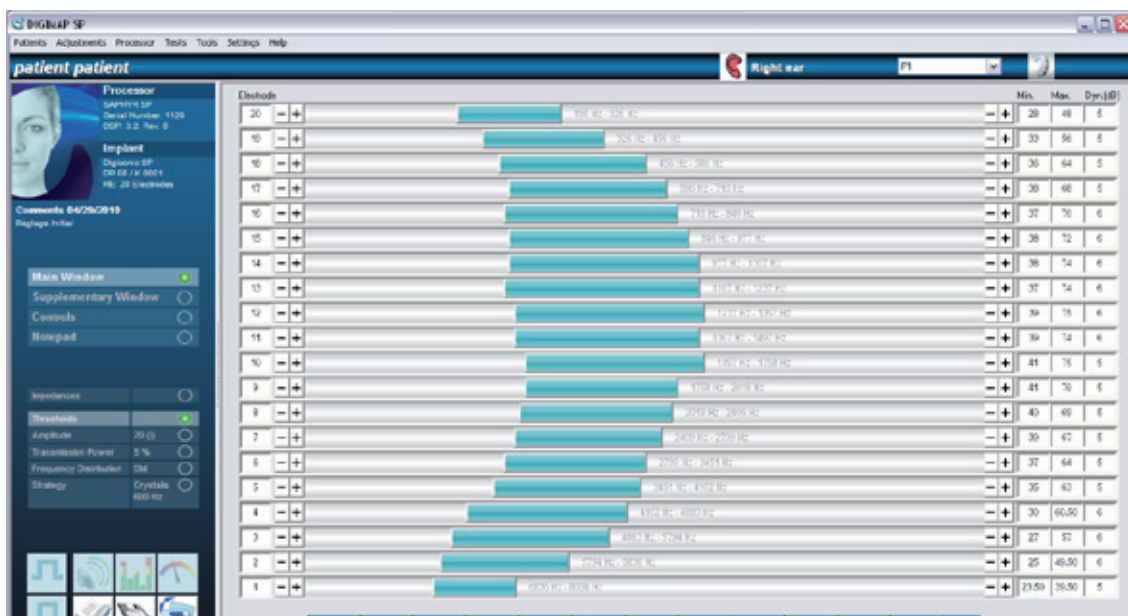
Once the user account is created, the login window will appear. Note that this window is the first window that opens when Digimap SP software is launched. Enter your login information and click on "Enter".



## B. Description of the fittings window

The Digimap SP 3.4.3 programming system is divided into three separate sections in order to simplify everyday use.

- Menu bar and information bar
- Function management (Vertical left-hand column)
- Available fitting Information (Right-hand side)



### 1) Menu/information bars

The upper section of the software provides access to all menu options (Patients, Processor, Fittings, Tests, Tools, Settings, Help) which will be explained in detail further on.

The information bar identifies the current patient file and processor and shows the current status of the system (connection status, stimulation status, selected ear, talk over test activated, etc.).



Information bar:

- Patient name
- Selected ear
- Selected program
- Type of processor
- Stimulation
- Talk over test
- Connection status

## 2) Functions

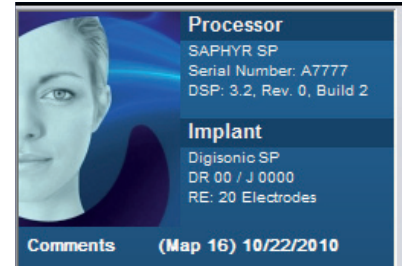
The vertical column is the reference section of the software and includes the following information:

- System identification
- Comments
- Management of parameters
- Shortcuts

### 2.1) System identification

The information stored in the identity card is sent to the main settings interface so that the audiologist can see it at all times:

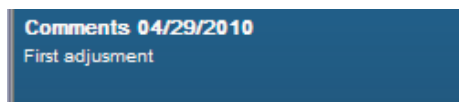
- Processor:
  - Type of processor
  - Serial number
  - DSP software version
- Implant:
  - Type of implant
  - Serial number
  - Type of electrode-array



Simply click on the image to display the patient identity card.

*Note:* If you are connected to a patient's processor, the information displayed (processor type, serial number, and DSP version) corresponds to the connected processor. However, when looking up a file, without a processor connected, the information corresponds to the processor that was attached during the fitting performed on that fitting's date.

### 2.2) Comments



The comments field makes it possible to view and add any notes that arise during a fitting session. Click on this field to activate it and use the "Enter" key to save the changes.

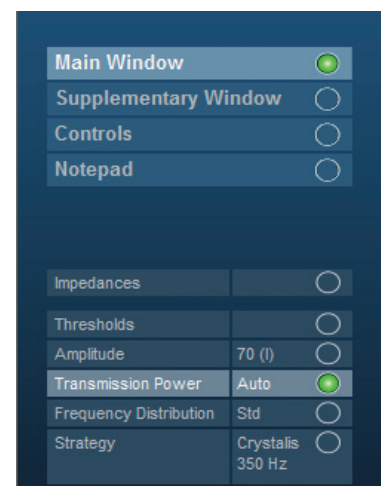
Each program has a comments field (P1/P2/P3/P4). Comments are displayed automatically as part of the "Save fitting" command, including at the end of the fitting procedure. This field also indicates the Map number (see the section entitled "Patient sessions", page 32) that has been assigned to the currently used program.

### 2.3) Management of parameters

This area is for managing fitting parameters. These parameters are grouped into several windows that correspond to the different stages of the fitting (Main, Supplementary, Controls).

Each window and parameter selected is identified by a green dot and blue band. The currently value of each parameter is displayed on the right. Any change to a parameter is only shown after it has been accepted.

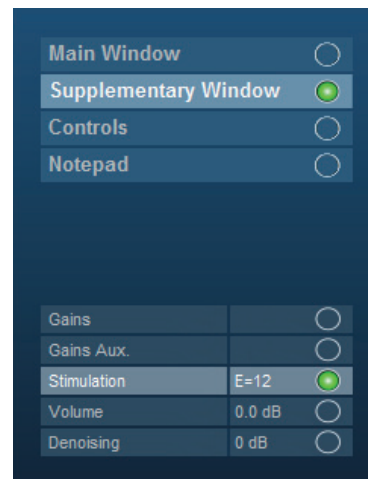
- Main window: designates the primary parameters to be adjusted and checked during a fitting:
  - Impedances
  - Thresholds
  - Intensity
  - Transmission power
  - Frequency distribution
  - Strategies



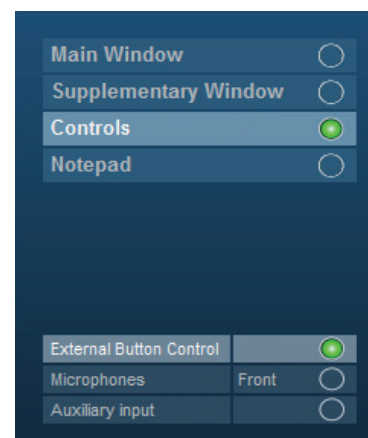
The Thresholds parameter sub-window is the default window displayed under the Main window. It is sent to the background whenever another parameter from the “Main Window” is selected. Click on the Thresholds window to re-activate it.

- Supplementary window: contains the parameters used for improving patient comfort:
  - Acoustic (specific to the Zebra® processor)
  - Gains
  - Stimulation
  - Volume
  - Denoising

The “Stimulation” parameters are automatically displayed in the fittings section while the “Gains” parameters are in the background. The parameters from the “Supplementary Window” are usually adjusted during the talk over test.



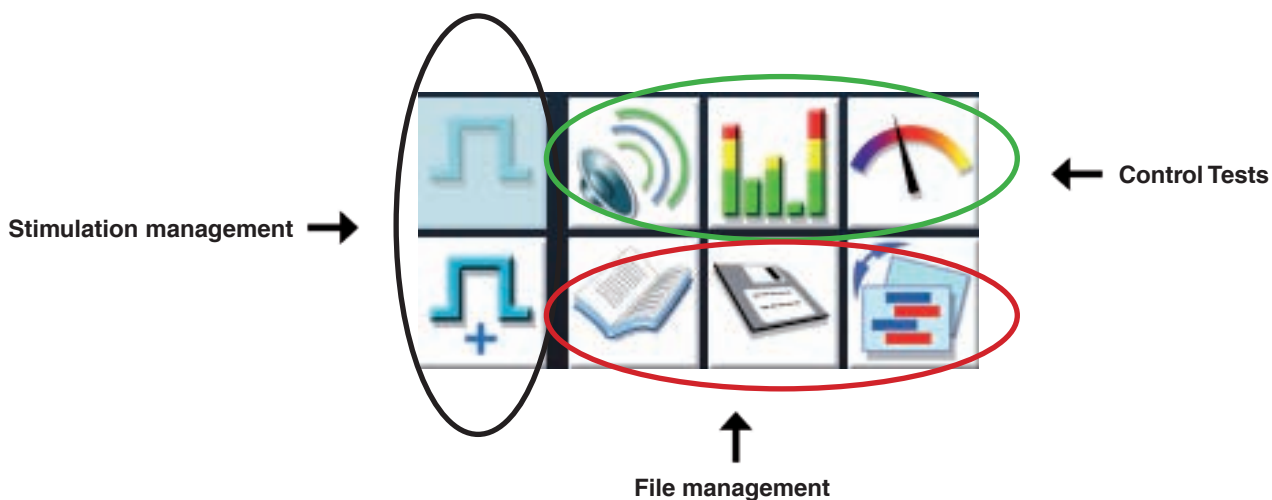
- Controls: configures the external processor controls (and input/microphone choices) available to the patient:
  - Button control
  - Microphones
  - Auxiliary input



#### 2.4) Shortcuts

The Digimap SP software offers direct access to certain functions using shortcuts icons found at the bottom and left of the screen. Some functions will be grayed out and not available when a processor is not connected.

The shortcuts have the following functions:





Start/stop calibrated stimulation (testing hearing/comfort thresholds)



Advanced stimulation (electrode sweep)



Start/stop talk over test



Digiscope



Vu-meter



Patient sessions



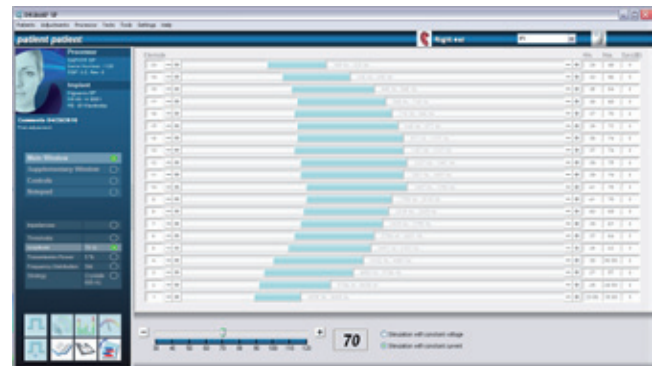
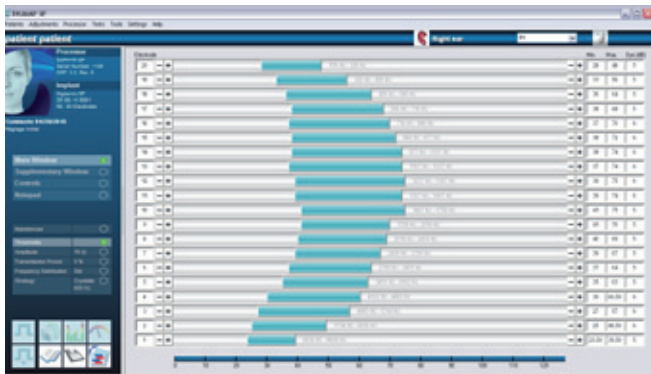
Save fitting



Fitting management

### 3) Fittings

The largest section of the Digimap SP software screen is for adjusting parameters. Depending on the choice of Main, Supplementary, Controls, or Notepad a predefined default parameter is displayed. For example, the “Thresholds” parameter is displayed when the “Main Window” is selected (as in the example below) and the “Gains” parameter is displayed for the “Supplementary Window”.



Selecting a different parameter from the sub-menu causes the default display to be greyed out and inactive while the selected parameters appear at the bottom of the window and are active.

Any change to a displayed parameter that is followed by a talk over test or a Digiscope test is automatically applied.

This change is only shown in the summary section of the left-hand column after it has been accepted via the dialog box “Accept modifications?” (clicking anywhere on the inactive section of the fitting area, or on any other parameter or menu make this dialog box appear).

## C. Description of menus

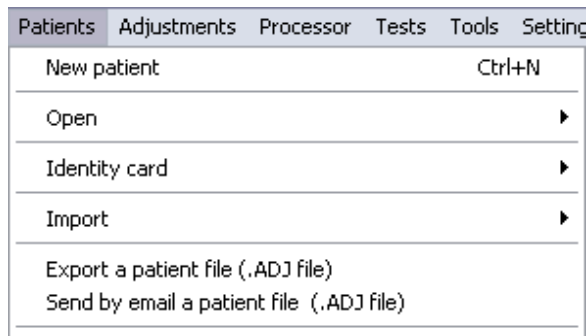
### 1) Patients Menu

The “Patients” menu provides access to options for managing patient files.



The options listed below are available in this menu. The most frequently used options will be presented further on in this document.

- New patient: creates a new patient identity card
- Open: opens an existing patient file from the local database
- Identity card: opens or exports the patient's identity card
- Import: imports a fitting from removable storage media (USB key, floppy disk, etc.)
- Export: export a fitting to removable storage media (USB key, floppy disk, etc.)
- Email: sends a patient's fitting by email
- Log out and change users: starts the procedure to end the fitting session, which includes several steps (saving the patient file, saving to removable storage media, programming the processor), then prompts to switch users
- Quit: same as the previous option, but closes the software at the end of the procedure.



### 1.1) New patient

The identity card provides information about the patient and the type of implant used (implant, processor). It also informs the user about the patient's etiology.

The identity card is composed of three main tabs:

- Required – Information necessary for identifying the patient and the cochlear implant system that is assigned to him/her.
- Optional – General information about the patient and implantation center
- Medical – Information about the patient's hearing loss (etiology, length of time, etc.)

It is now possible to include multiple systems (implants or processors) used by the patient in this identity card. Their status is automatically displayed (for example: current processor, spare, being repaired, etc.)

#### a) Required

The information contained in this window must be filled out completely in order to validate the identity card, and gain access to the fittings window (this is particularly important for the first fitting).

- Identity:
  - Last name
  - First name
- Implant:
  - Type of implant
  - Surgery date
  - Implanted ear
  - Serial number
  - Electrode-array

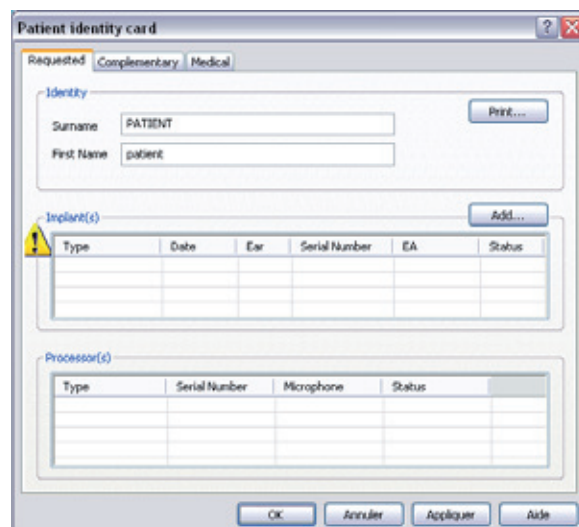
The status of the implant is automatically displayed

- Processor:
 

Information about the processor is automatically detected by the software and displayed in the identity card (notably the type and serial number).

The following types of processors may be detected:

- Saphyr® SP
- Saphyr® CX
- Zebra®
- Digi SP
- Digi SP2 (with LED)
- Digisonic® BTE
- Digisonic® BTE2 (with LED)
- Digi SPK 2
- Digisonic® BW, etc.



**Notes:** During an actual fitting, it is best to first connect the patient's processor while the processor is not on the head, then fill out the identity card.

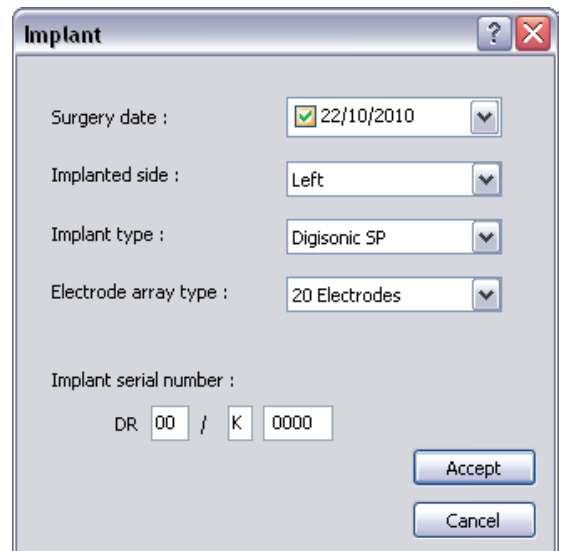
Moreover, it is possible to list several processors per patient. Whenever the patient's fittings are loaded into a processor other than his/her usual processor, it will be detected and the nature (spare, permanent exchange, etc.) of the new processor will need to be specified when it is connected. The new processor is then automatically included in the list of processors used by the patient.



Type	Serial Number	Microphone	Status
DIGI SP2	6489		Spare
DIGI SP	0586		Repair
DIGI SP2	8362		Former spare
DIGI SP2	4507		Former spare

Information about the implant is filled out in the window below. This window can be accessed by directly clicking on the implant in question or, when identifying a new implant (if this is the first fitting), by clicking on the "Add" button.

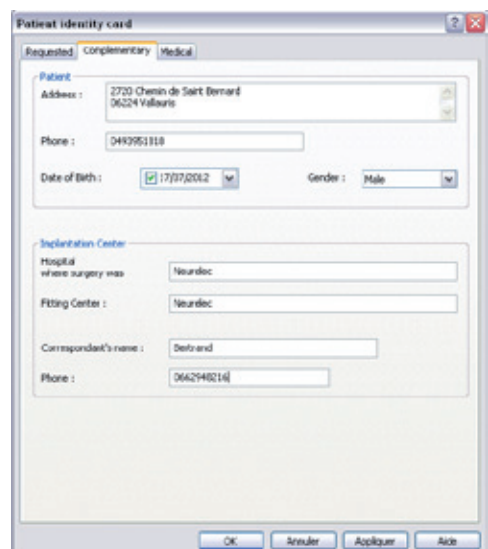
- Surgery date: a calendar is provided to help you select the correct surgery date
- Implanted side (left, right): it is very important to correctly specify the side that the patient was implanted on, especially in the event of bilateral or binaural implantation
- Implant type (from the Digisonic® or Digisonic® SP range)
- Electrode type: the types of listed compatible electrode-arrays depend on the type of implant selected. For example, for a Digisonic® SP implant, the electrode-arrays can be: 15-20 electrodes (standard), ABI, multi-array (2 EA 12, etc.).
- Implant serial number: the serial number can be found in the operative report from the surgical procedure, or on the patient's cochlear implant owner card. This serial number comes in the same naming format regardless of the type of implant in question: 2 numbers – 1 capitalized reference letter – 4 numbers:
  - Digisonic® DX10: XX /A/ XXXX to XX /D/ XXXX
  - Digisonic® Convex: XX /E/ XXXX
  - Digisonic® SP: XX /H/ XXXX to XX /K/ XXXX
  - Digisonic® SP Binaural: XX/J/XXXX or XX /L/ XXXX



### b) Optional

"Optional" information makes it possible to provide general information about the patient (address, telephone number, date of birth, gender).

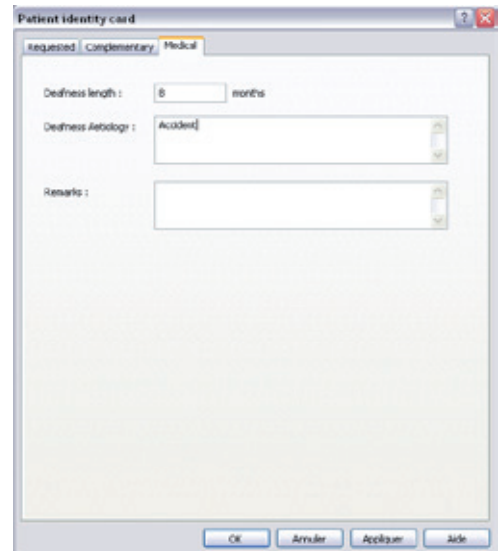
It is also possible to fill out information about the implantation center and follow-up to fittings. This information is automatically added according to information that was provided when installing the Digimap SP software. Content in the "Optional" tab is not required in order to validate the identity card.



### c) Medical

The “Medical” tab makes it possible to add additional information about the patient’s etiology and the duration of the hearing loss.

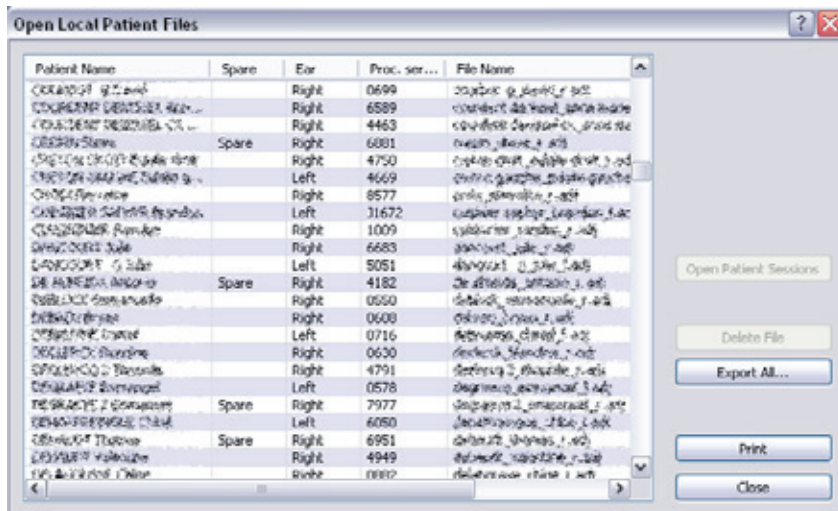
This information is not required in order to validate the identity card.



## 1.2) Open

### a) Local patient file

It is possible to open a patient file that has been saved in the computer’s local database.



In the patient file, it is possible to view the following information:

- The patient’s name
- The processor’s status (if the current processor is a spare device)
- The implanted side
- The associated patient file name

**Warning:** Selecting the correct implanted ear (side) is critical. For safety reasons, it is not possible to select a patient’s left ear if the processor is associated with the right ear. Furthermore, the side that the ear is on is indicated in associated patient’s file name for all new patients. For example, “Last name\_First name\_L. adj” is for a patient who received an implant in his/her left ear.

- To open the fitting, click the patient file and select “Open Patient Sessions”. This will list all available historical patient sessions.
- The patient file can also be deleted from the local database using the button “Delete File”.
- The “Export All” function copies the patient files to a folder in .csv format.
- The “Print” function prints a list of the patients with their addresses and telephone numbers.

### b) Local patient file for the opposite side

In cases of bilateral (not binaural) implantation, once the fitting is finished on one side, it is possible to select the patient’s other side directly from this function. The assigned shortcut is CTRL+K. It can be used as long as the two files (left and right) have already been created.

### c) Saphyr® demo file

The Saphyr® demo file is a preset fitting template used to view most of the parameters available during a fitting without having to connect a processor (please note, some parameters are not visible in the fittings window if no processor is connected). This file is a useful tool for demonstrations, particularly during training on how to use the Digimap SP software.

#### 1.3) Identity card

The “identity card” function makes it possible to access general information that has been provided about a patient whose patient file already exists.

Two options are available:

- Edit: This function displays the identity card of the patient whose file is currently in use.
- Export: The identity card can be exported in .csv format once the corresponding patient file has been selected and opened.

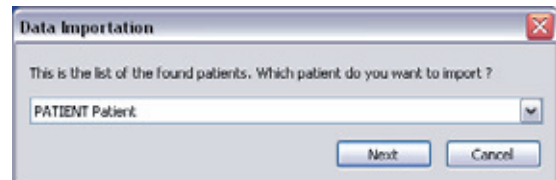
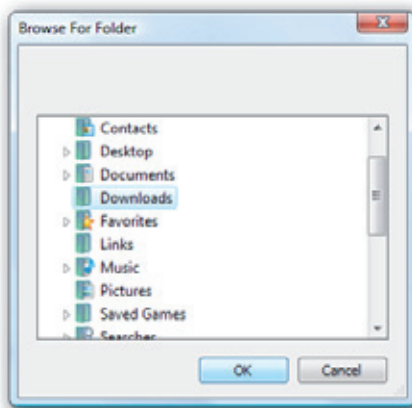
#### 1.4) Importing a fitting

If the patient's fitting is not stored in the computer, it is possible to read the fitting stored on the patient's floppy disk or the Neurelec USB key. To do so, simply click on “Patient file stored on Neurelec disk” or “Patient file stored on Neurelec USB key” depending on the storage media used.

If the storage media (Neurelec USB key or disk) has not been selected in the “Settings” menu, the associated fields appear shaded and cannot be accessed. In this case, it is possible to manually search for the desired patient file by clicking on “Patient file”.



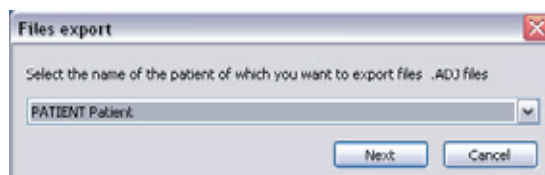
A window appears that allows you to browse the computer's folders and select the folder containing the patient file that you are looking for. Select the location, then click “OK”. Then simply select the patient's name in the list that is displayed.



*Note:* When importing data, if there is already a file for the patient in the local database, the software will ask if you want to merge the data. The software will then copy the patient file from the storage media to the local database and will rename it (with the name format “last name\_first name\_numbers”). The program will then automatically begin searching for duplicated files. Select the two relevant files as indicated in the section entitled “Merge files”, page 45.

#### 1.5) Export a patient file

The “Export a patient file” function copies a file stored in the local database to the external storage media (USB key or other).



## 1.6) Email a patient file

The “Email a patient file” function sends the settings by email by automatically including them as an attachment in a new email. This function obviously requires the use of an email software program that has been previously installed and configured in Windows (“Microsoft Simple MAPI” compatible).

*Note:* If no email program has been installed on the computer or if the program is not compatible, it is still possible to send the patient file by email using the Neurelec email server. To do so, the parameters must be configured in the “Settings/Preferences/Internet” menu.

## 2) Fittings Menu

The “Fittings” menu provides access to various options for managing a fitting session in progress.

The options listed below are available in this menu. The most frequently used options will be presented further on in this document.

- Patient sessions: all of the fittings saved in the patient file
- Save fittings: saves the fittings in the patient file (not to be confused with programming the processor)
- Fitting management: copies one program to another
- Enable all electrodes: selects and activates all electrodes
- Duration of stimulation: various functions that are useful for easily setting thresholds (increase/decrease all thresholds, interpolate, etc.)
- End of the fittings session: starts the procedure to end the fitting session, which includes several steps (saving the patient file, saving to removable storage media, programming the processor)

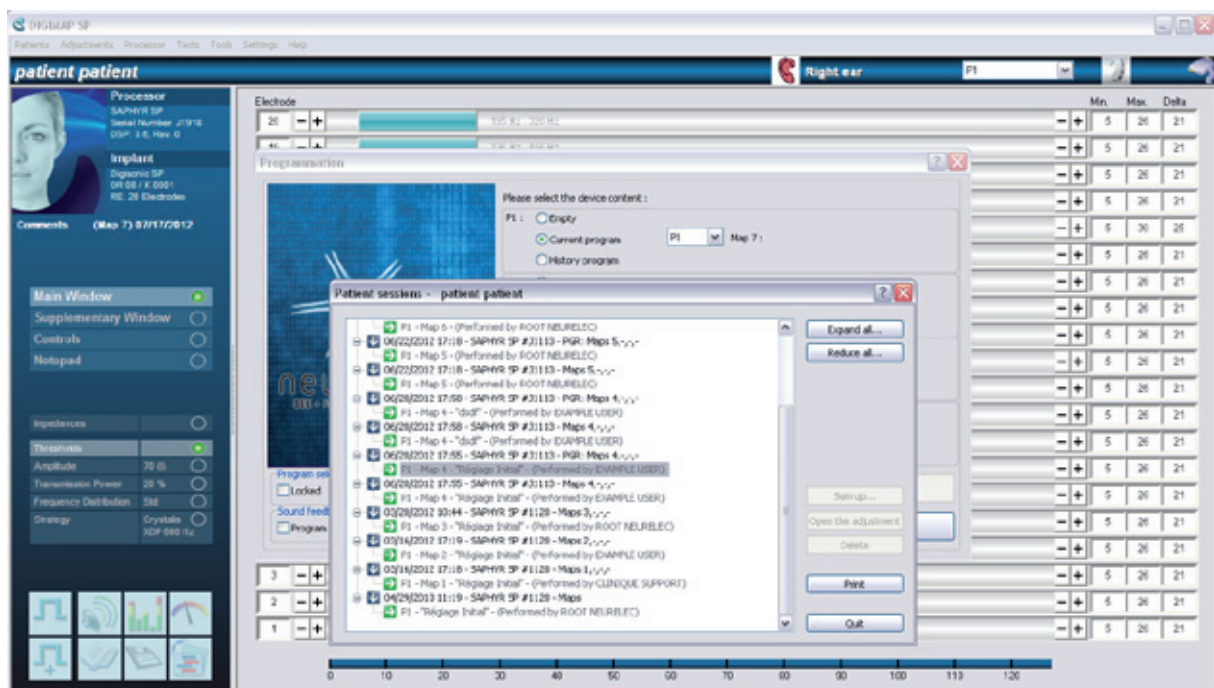
Adjustments	Processor	Tests	Tools	Settings	Help
Undo					Ctrl+Z
Patient sessions					
Adjustments recap					Ctrl+R
Save adjustments					Ctrl+S
Generate an anonymous file of adjustments					
Print the adjustments					Ctrl+P
Adjustment manager					Ctrl+W
Enable all the electrodes					Ctrl+E
Presets (fast adjustments)					Ctrl+T
Durations of stimulations					▶
Selection					▶
End of the adjustments session					

### 2.1) Cancel the change

If the change made during the fitting session is unsatisfactory, it is possible to undo it by clicking this function or by using the shortcut CTRL+Z.

### 2.2) Patient sessions – Map numbering

The “Patient sessions” window displays all of the historical fitting sessions saved in the patient file. This window can be accessed at any time during a fitting.



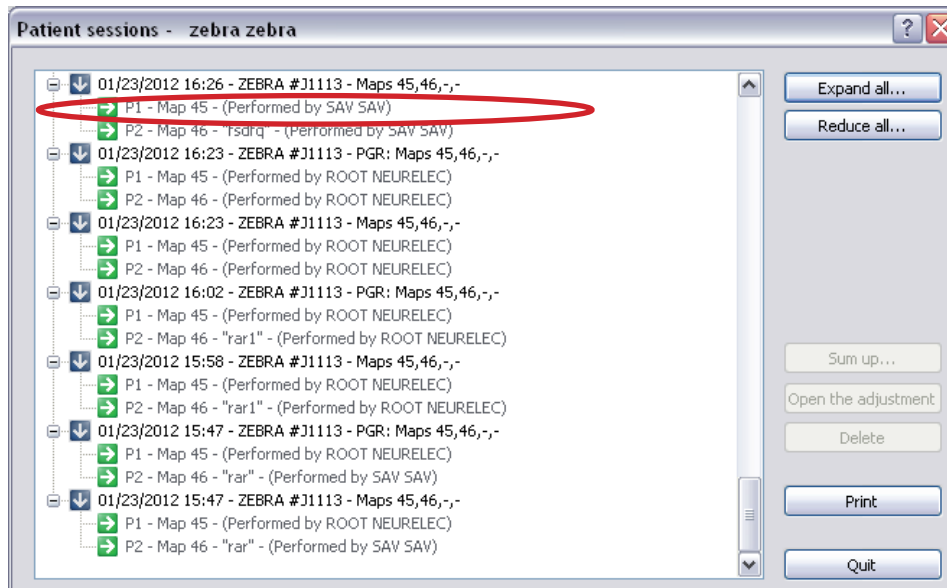
The following information is provided about each saved session:

- Fitting date
- Fitting time
- Processor type and serial number
- Map numbers of the different programs
- The person who performed the fitting
- Any comments noted by the audiologist during the fitting (fittings that were programmed into a processor have the prefix "PGR").

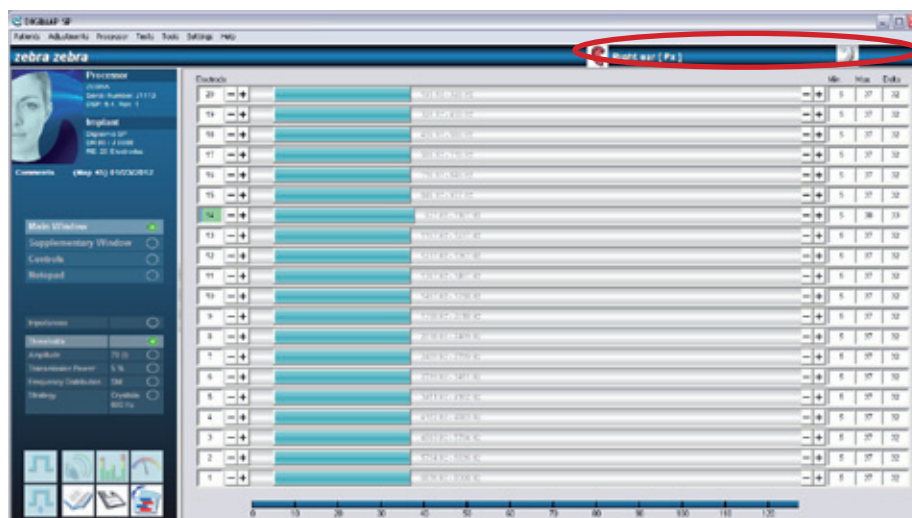
The information in the "Processor" section enables the user to track the processors being used over time (type and reference). Whenever a fitting parameter is changed and saved to the computer, the MAP number increases by one.

### *Difference between Px mode and session mode*

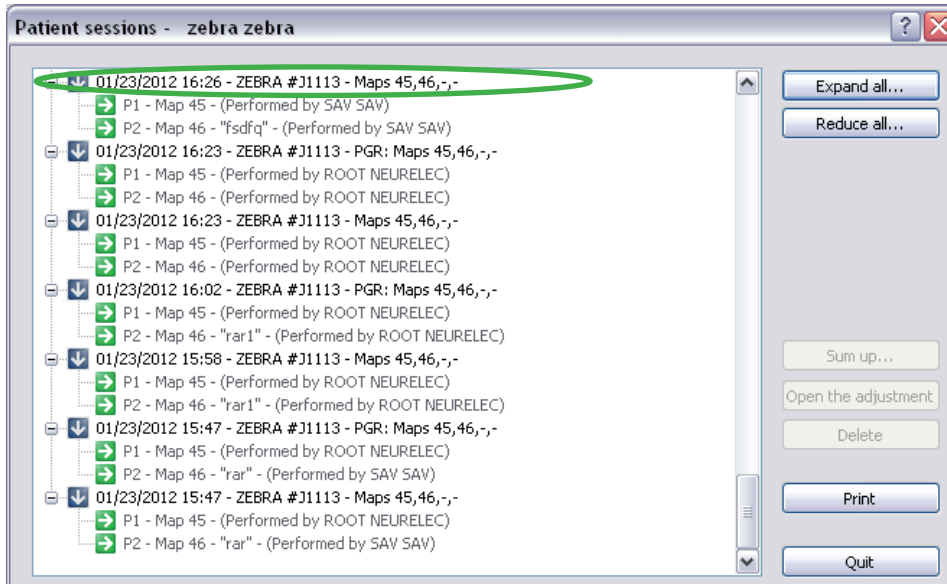
The difference between Px mode and session mode refers to the ability to now view the MAPs one by one, or else load the entire fitting session.



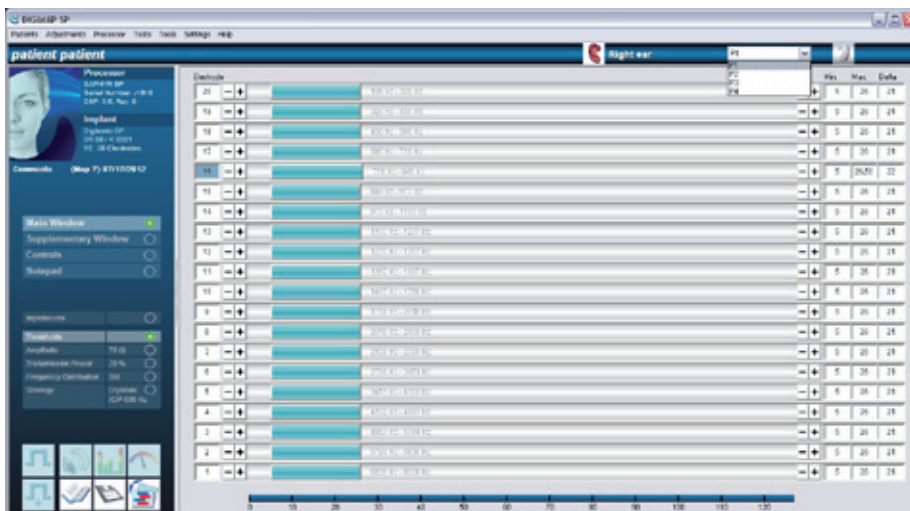
If the users loads MAP 4 existing in program P1, only MAP 4 is displayed in Px mode.



Therefore only MAP 4 appears on the screen, and the fittings for P2, P3 or P4 are not visible. To view these, you need to switch to session mode and select the entire session, including the example above for MAPs 4, 3 and 2 respectively existing in programs P1, P2 and P3. (Click on the session in the green circle)



When the session is selected, the user then has access to all of the existing programs in this session as shown below.



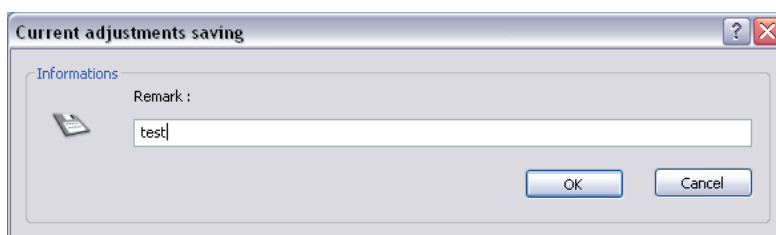
### 2.3) Fittings recap

This option displays all information about a fitting session. Select the program from the drop-down menu at the top of the window in order to go to a summary of the corresponding parameters. The shortcut for accessing the fittings recap is CTRL+R.

The printed recap displays certain parameters graphically (thresholds, frequency distribution, gains, etc.).

### 2.4) Save fittings

This function enables you to save the current fitting in the patient file at any time. It is particularly recommended to add a comment during each save, which will be displayed in the history of patient sessions.



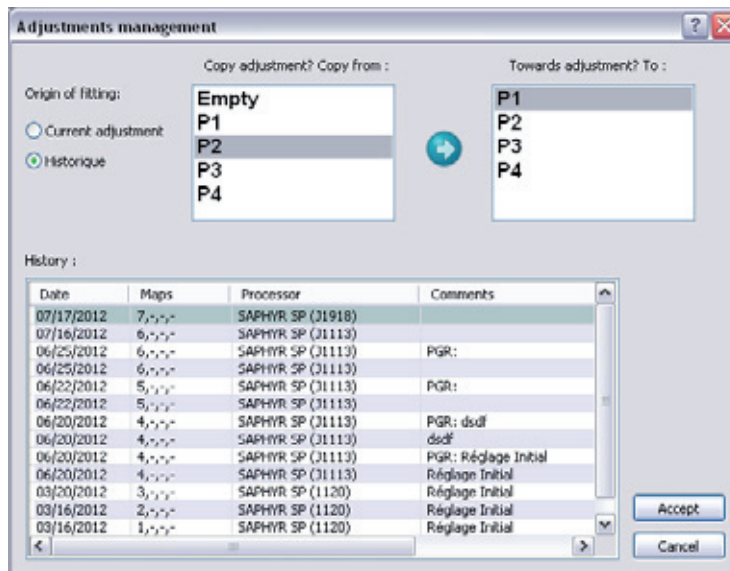
The comment displayed in the vertical column of the fittings window is automatically copied to the "Save fittings" window when saving at any time during a fitting or at the end of the fitting procedure. This comment can be changed, which is particularly useful during the final save. The shortcut for saving a fitting is CTRL+S.

## 2.5) Print the fittings

The “Print the fittings” function lets you print the fittings recap displayed on the screen.

## 2.6) Fitting management

The “Fitting management” option copies all of the parameters from one program to another program. It is possible to copy parameters from one program in a current fitting session to another program in the same session, or from any program from a previous fitting session into a program in the current session. To access historical programs, click “History”. This will display a list of all of the fittings saved in the patient file. Select the desired session and then copy the programs you desire (see Map numbering).



This option is always used when the program that will be used from day to day has been validated with the patient and the audiologist wishes to define another program.

For example, the window above indicates that program P2 (the program is automatically displayed by the software when the processor is connected), which is from an earlier session that has been selected in the list after clicking on “History”, will be copied to current program position P1. The program P1 can then be changed further to adapt it to the patient’s specific needs (outdoor environment, music, etc.).

## 2.7) Enable all electrodes

For the first fitting, all of the electrodes are disabled. This function enables all of the electrodes at once. The shortcut is CTRL+E.

## 2.8) Presets (fast fittings)

In order to speed up the fitting procedure according to the needs of each patient, new pre-established fitting modes (presets) are now available in this version of the Digimap SP software (except for the Digi SP and Digisonic® BTE without LED processors).

Each mode has parameters (gains, volume, loudness equalization, etc.) that were chosen to correspond to a specific sound environment

- Noise Mode
- Telecoil Mode
- Phone Mode

**Important:** These modes offer suggested parameters for these given situations. Once the parameters have been applied, it is always possible to change their values later on. It is also possible to restore the default parameters by clicking the respective button. The shortcut for this function is CTRL+T.



## 2.9) Duration of stimulation

### a) Increase/decrease all thresholds

This function increases/decreases the detection thresholds and comfort thresholds simultaneously. It shifts the dynamic range of all of the electrodes.

The shortcuts for this function are the following:

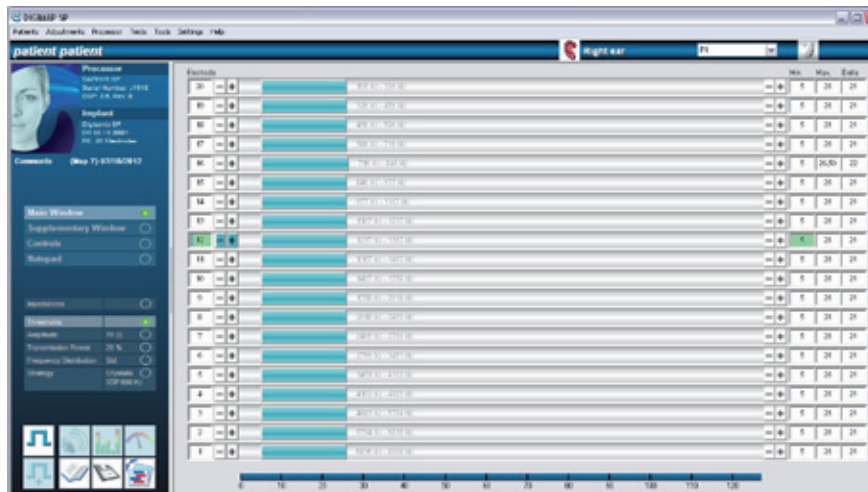
- Increase all thresholds: CTRL+I
- Decrease all thresholds: CTRL+U

### b) Tilt +/- function for all thresholds

This function balances the dynamic ranges of the low- and high-pitched electrodes around an electrode chosen by the audiologist by “rotating” the setting around this reference electrode (this function is unavailable for setting a Digisonic® SP Binaural implant). The purpose of this function is to more easily balance the low and high pitches of the perceived sound without having to check all of the thresholds again.

### *Procedure:*

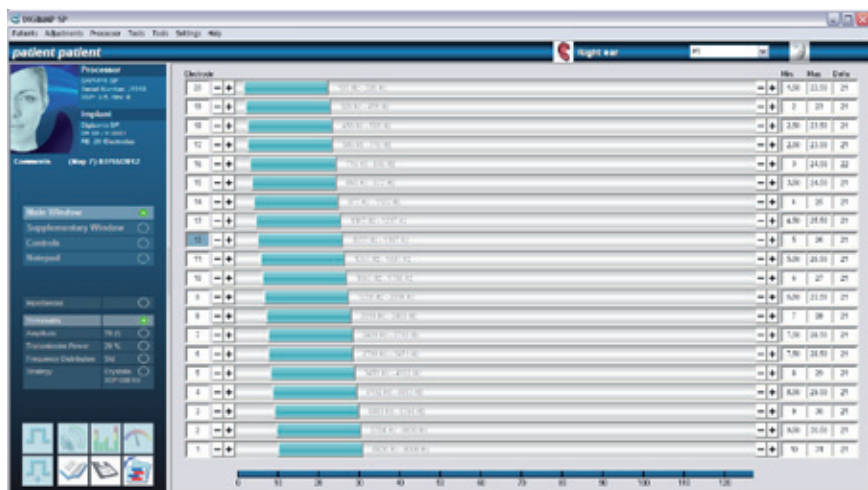
- Select the reference electrode by clicking on its Min. or Max. threshold. It is strongly recommended to use a middle electrode (electrode 10, for example) as the reference electrode.



- Apply a Tilt + to the thresholds in order to:
  - Increase the Min. and Max. thresholds of the electrodes below the reference electrode (in this example, electrodes 1 through 9)
  - Decrease the Min. and Max. thresholds of the electrodes above the reference electrode (in this example, electrodes 11 through 20)

This function can also be accessed using the shortcut CTRL+G.

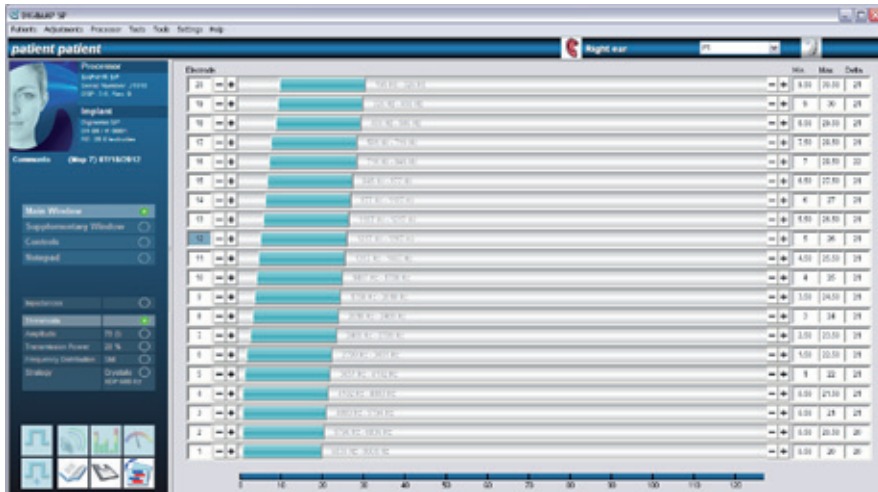
Here are the results from the previous Map after carrying out 15 “Tilt +” actions:



- Apply a Tilt - to the thresholds in order to:
  - Decrease the Min. and Max. thresholds of the electrodes below the reference electrode (in this example, electrodes 1 through 9)
  - Increase the Min. and Max. thresholds of the electrodes above the reference electrode (in this example, electrodes 11 through 20)

This function can also be accessed using the shortcut CTRL+F.

Here are the results of the original Map after carrying out 15 “Tilt -”:



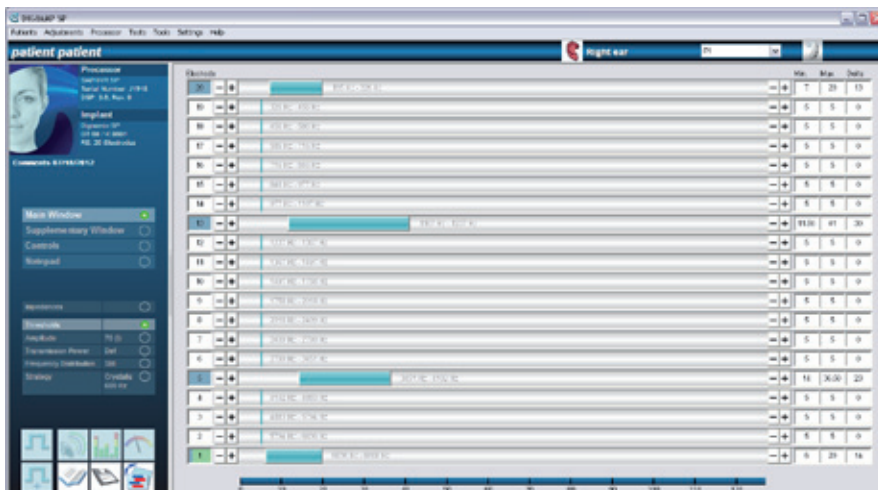
c) Interpolate

The “Interpolate” function lets you create a Map using 4 Min. thresholds and 4 Max. thresholds (this function is unavailable for setting a Digisonic® SP Binaural implant). A 4th order polynomial interpolation is performed using the 4 Min. and Max. thresholds to produce a uniform MAP without having to test all of the patient’s Min. and Max. thresholds.

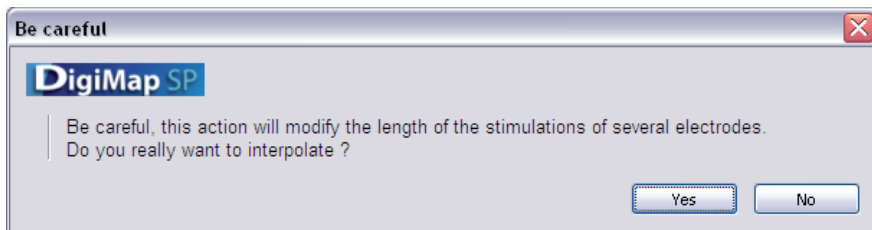
*Procedure:*

- It is first necessary to define the Min. and Max. thresholds of 4 electrodes:
  - Always choose the most basal and most apical electrode (usually electrode 20 and 1)
  - Choose the 2 other electrodes so that the 4 electrodes will be evenly distributed among all of the active electrodes (do not choose electrodes 12 and 13)

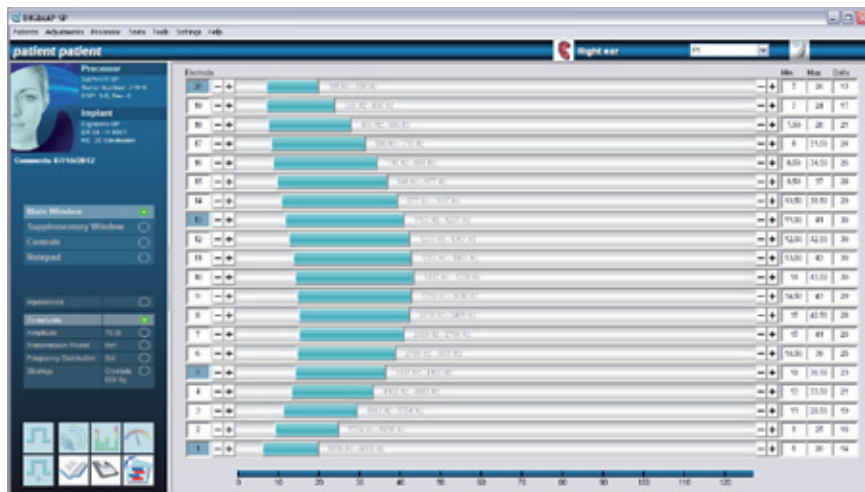
Here is an example of 4 tested electrodes:



- Once the Min. and Max. thresholds have been determined for the 4 electrodes, the interpolation procedure can now begin:
  - Select the 4 electrodes by holding down the CTRL key while clicking on the 4 electrode numbers (the numbers in the “Electrode” column in the thresholds window).
  - Go to the “Fittings/Duration of stimulation “ menu and click on “Interpolate” (shortcut CTRL+O)
  - A warning message appears:



- Confirm the interpolation by clicking OK
- The new interpolated Map will then appear:

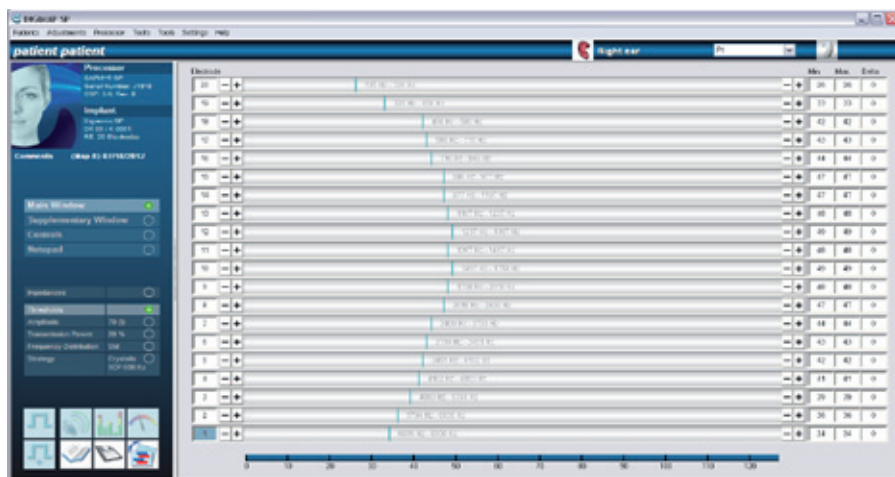


#### d) Estimate Min. thresholds

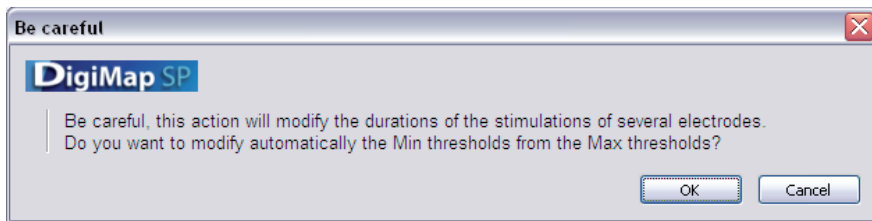
In keeping with the goal to simplify the fitting method, it is now possible to estimate thresholds. Once the Max. thresholds have been determined by the user, clicking on the “Estimate Min. thresholds” function (shortcut CTRL+M) will set the Min. thresholds to 10% of the Max. threshold levels.

#### Example:

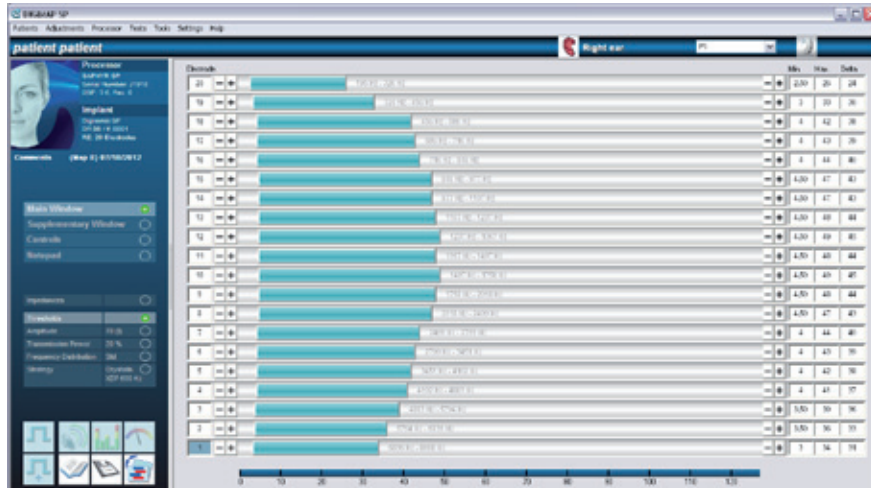
- Determine the Max. thresholds with the patient. The following Map is obtained:



- Click on the “Estimate Min. thresholds” function (or the shortcut CTRL+M)
- A warning message appears. Accept the changes by clicking OK



- The Min. thresholds are set to be 10% of the Max. threshold values. The final Map obtained is the following:



### 2.10) End fitting session

This function starts the procedure to end the fitting session. The following steps must be carried out before disconnecting the processor:

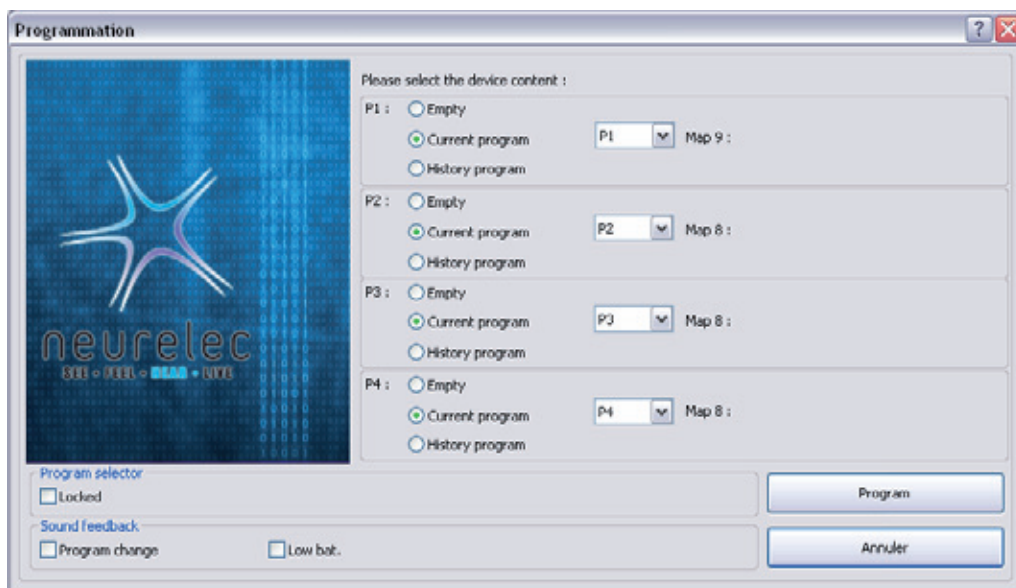
- Save fittings in the computer's local database
- Program the processor
- Adjust the selector wheel

### Programming MAPs at the end of the fitting session

Whenever a MAP is changed and saved, the MAP number is increased by one.

The user can assign a specific MAP to each program (P1, P2, P3, P4) in a dialog box at the end of the fitting session.

The same number appearing in multiple programs means that these programs are identical. An empty program is represented by " - ".



Before programming the processor, it is good practice to view the programs that will be programmed. It is also advisable to check if the program selector is locked (or unlocked) as desired and whether the auditory alarm is configured as desired.

### 3) Processor Menu

The "Processor" menu provides options for interfacing with a processor.

The following options are available in this menu; they will be presented later on in this document:

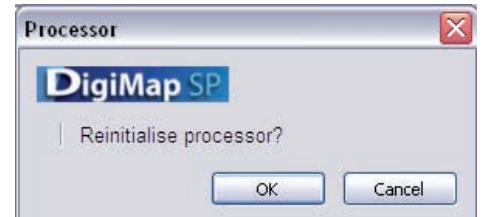
- Connect (see the section entitled "Connection", page 54): process for connecting the processor to the settings interface
- Reinitialize the processor: resets the processor
- Update Digisonic® software: reprograms the version of the DSP software for Digisonic® SP processors.

Processor	Tests	Tools	Settings	He
Connect				F12
Reinitialise the processor				
DIGISONIC software update				

#### 3.1 ) Reinitialize the processor

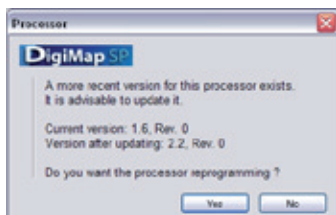
This option resets the connected processor in order to completely clear its parameters. Using this option causes the processor to permanently lose all of its data.

This procedure can only be carried out on a processor that is already connected, and lasts only a few seconds. The connection with the processor is automatically interrupted once it is reset.



This step is **strongly recommended** when exchanging a processor that is already programmed (a processor onto which a new patient file must be loaded, but which is already programmed with another patient file) in order to avoid the risk of unsuitable or even painful stimulation. In such case, it is recommended to first reinitialize the processor, then load the new patient file during the connection process.

#### 3.2) Update the processor



processor with DSP software version 3.0).

Digimap SP automatically prompts you to reprogram the processor when it is connected. If you have already clicked "No", you can still choose to reprogram during the fitting session by going to the "Processor" menu.

This option reprograms the processor in order to update the DSP software version.

It will only prompt you to update if you are also using the latest version of the programming system (for example, Digimap SP 3.4.3 will prompt to reprogram the

Reprogramming gives the patient the ability to benefit from the latest updates that are compatible with the type of processor in question (to manage auxiliary inputs, automatically optimize transmission power, etc.).

The window indicates the processor's current version and displays the possible versions for reprogramming in a drop-down menu. It is always recommended to program the device with the most recent version (in this example, version 3.0).

### 4) Tests Menu

The "Tests" menu provides access to various options for managing a fitting session in progress.

The options listed below are available in this menu. The most frequently used options will be presented further on in this document:

- Stimulation
  - Normal stimulation of one or several electrodes (shortcut: F2)
  - Advanced stimulation (shortcut: F3)
- Tests
  - Talk over test
  - Advanced talk over: ability to select the denoising level (or sensitivity level for the Digi SP and Digisonic® BTE processors) during talk over testing
- Measurements:
  - Digiscope: view the saturation level of each electrode
  - Advanced Digiscope: Digiscope function with the added possibility of adjusting the parameter value associated with the wheel settings in real-time
  - Vu-meter: checks the integrity of the microphones and the Telecoil/AUX inputs

Tests	Tools	Set
Stimulation		▶
Voice		▶
Measures ▶		

#### 4.1) Stimulation

##### a) Stimulation

The "Stimulation" function (shortcut F2) stimulates at the Min. or Max. threshold of the selected electrode.

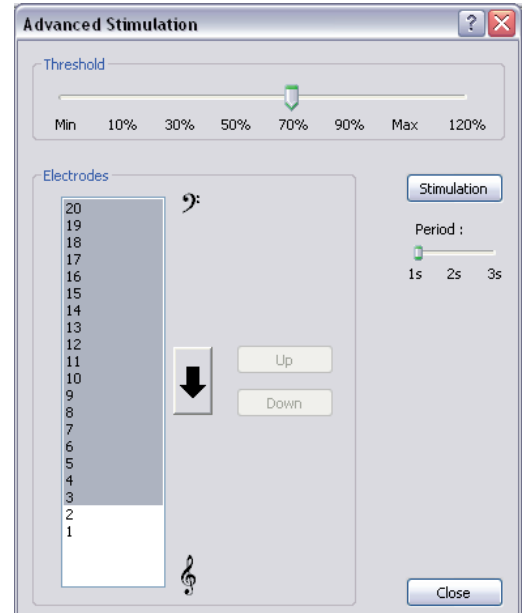
##### b) Advanced stimulation

Advanced stimulation makes it possible to check whether the loudness of each electrode is balanced correctly with other electrodes, thus enabling you to check the threshold fittings that were previously made.

##### Procedure:

- Use the SHIFT and CTRL keys to select a group of electrodes,
- Using the cursor, define the stimulation level (expressed as a percent of the Max threshold level)
- Click on "Stimulate" to start a sweep of the selected electrodes. The patient should indicate if the perceived loudness of any one of these electrodes is different from the others. The goal is to obtain consistent loudness across all electrodes
- If one electrode does stand out as having a level that is too low or too high, return to the Thresholds window and readjust its threshold
- Click on the arrow to switch the order of stimulation (low- to high-pitched electrodes, or the reverse)

*Note:* It is possible to change the amount of time between two stimulations so that the patient can easily compare the selected electrodes.

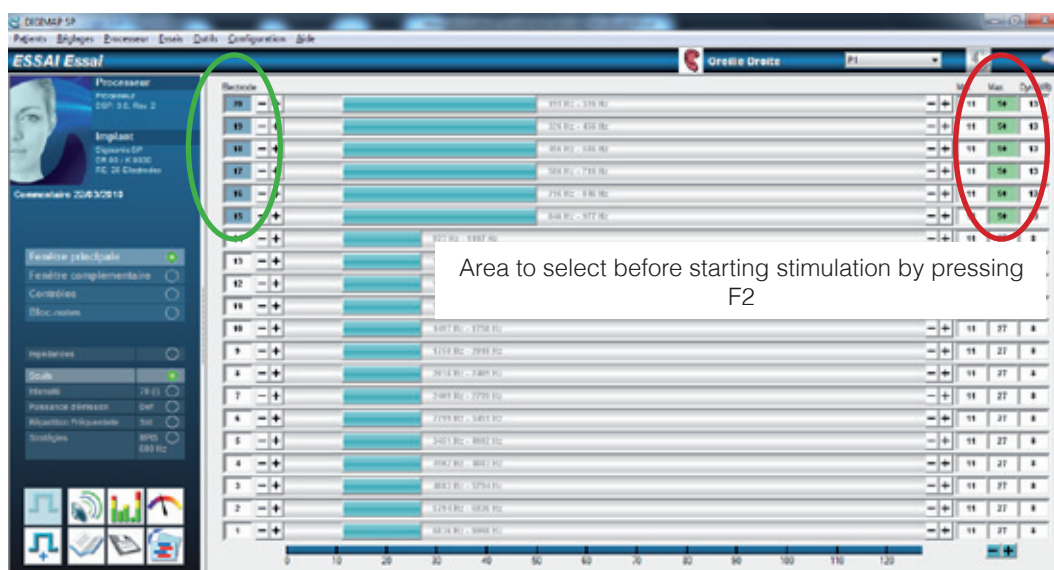


##### c) Stimulate a group of electrodes

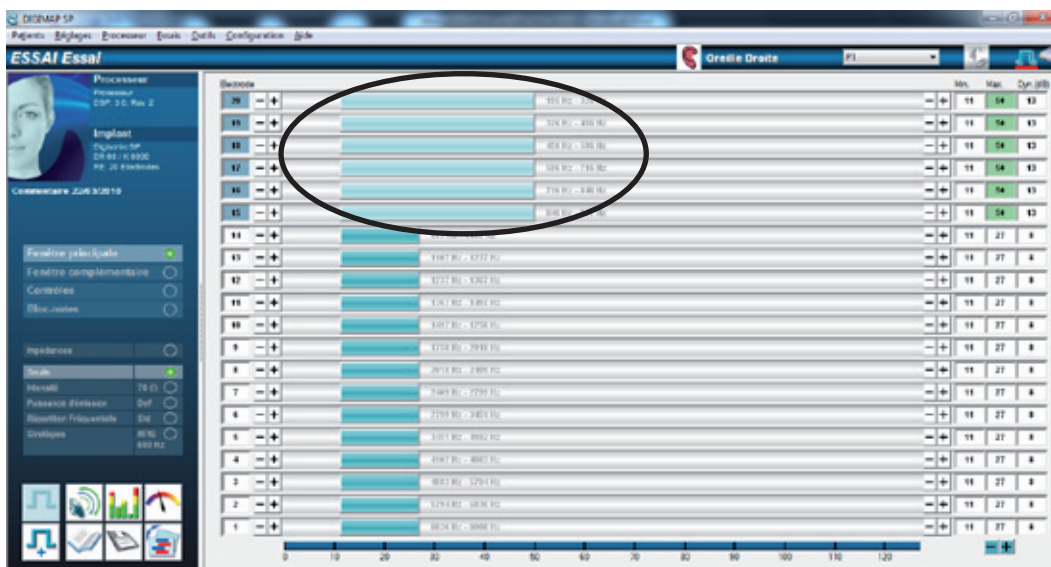
The new version of Digimap SP makes it possible to stimulate groups of electrodes in order to quickly determine the patient's Min. and Max. thresholds.

##### Procedure:

- Select the group of electrodes to be tested using the SHIFT (blue circle) and/or CONTROL keys
- Select the desired stimulation level (depending on whether you are testing detection thresholds or comfort thresholds) by double-clicking on the heading "Min." or "Max." at the top of the column for the chosen electrodes. The boxes that correspond to these values, the Max values in this example, appear in green (purple circle).



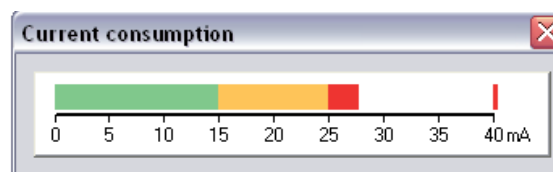
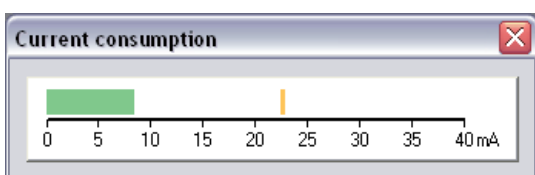
- Start stimulation using the shortcut F2: in this example, all of the electrodes are stimulated at the patient's comfort threshold and flash at the same time (black circle).



#### 4.2) Talk over test – Advanced talk over

During a talk over test, the processor's microphone is activated and the patient hears the surrounding sound environment. Any change in the position of the processor's control buttons (sensitivity selector wheel or program selector) has no impact on the patient's perception during the talk over while he/she is connected to the interface. Rather, the level of the parameter being configured (gain/denoising for a Saphyr® SP processor) is defined in the corresponding fittings window, and the program being used is selected from the software's drop-down menu.

Before going into detail about the options available during a talk over test, it is important to introduce the current consumption feature.



The current consumption window displays the average amount of current used by the connected processor during any talk over test (standard or advanced). The indication of this level gives you information about the device's battery life. This current consumption window displays an immediate snapshot of the processor's consumption level in a horizontal bar.

The amount of current is indicated in milliamperes (mA). It is displayed in three distinct zones:

- Green zone (0-15mA): normal consumption
- Orange zone (15-25mA): borderline consumption
- Red zone (>25mA): overconsumption

Overconsumption rarely occurs with a Saphyr® SP or Digi SP behind the ear processor. It is, however, important to check this parameter, particularly during the first several fittings, in order to assess whether it is necessary to change the fitting (the thickness of the skin has a direct impact on the transmission power and thus on consumption).

*Note:* When fitting a Digi SP'K processor, current consumption is not displayed.

- During a standard talk over test (shortcut or menu "Fittings/Talk Over"):
  - For Saphyr® SP and Saphyr® CX or Zebra® processors, the minimum noise level corresponds to the relative value that has been defined in the fittings window of the "Denoising" parameter
  - For Digi SP and Digisonic® BTE processors, the microphone's sensitivity level corresponds to the value that has been defined in the fittings window of the "Sensitivity" parameter
  - When the potentiometer's selector wheel is in its highest position, this level corresponds to the value defined in the fittings window of the "Denoising" / "Sensitivity" parameter. The selector wheel's range of variation offers 10dB of attenuation between the highest and lowest positions. Thus:
    - If the "Denoising" parameter is set at 0dB in the software, the patient will be able to adjust the minimum sound level between 0dB (selector wheel position "3") and -10dB (position "0" before turning off) depending on the environment.
    - If the "Sensitivity" parameter is set at 35dB in the software, the patient will be able to adjust the sensitivity level between 35dB (selector wheel position "3") and 45dB (position "0" before turning off) depending on the environment.

- During an advanced talk over test (menu “Fittings/Advanced Talk Over”), the denoising/sensitivity level can be modified in order to define with the patient the most appropriate setting for his/her comfort and lifestyle. This function is particularly used in cases where it is necessary to lock the selector wheel (the elderly, very young children, etc.) at a predefined level of denoising/sensitivity.



A cursor going from 0 to -10dB reflects the position of the processor's selector wheel (highest to lowest position). The audiologist is thus able to start the talk over test by testing different sound levels. It is also possible to let the patient adjust the selector wheel position him/herself (check the box in such case) in order to define the most comfortable level.

In the example above (setting a Saphyr® SP processor), -5dB of attenuation makes it possible to test the denoising level associated with the middle position of the selector wheel and thus evaluate the patient's hearing comfort at this position.

In the same example, if the level defined in the “Denoising” fittings window is 0dB and during the advanced talk over test the patient prefers -5dB. One can set denoising parameter to -5dB in the denoising window and then lock the selector wheel's position in the “Button control” window to force the denoising to always be -5dB.

In the same example, for a Digi SP or Digisonic® BTE processor, if the level defined in the “Sensitivity” fittings window is 35dB and during the advanced talk over test the patient prefers +5dB. One can set sensitivity parameter to 40 dB in the Sensitivity window and then lock the selector wheel's position in the “Button control” window to force the sensitivity to always be 40dB.

*Important:* Depending on the setting chosen by the audiologist for using the potentiometer, the advanced talk over test may also make it possible to adjust the analog gain for Saphyr® generation processors used with non-binaural implants (see the section entitled “Potentiometer”, page 76).

#### 4.3) Measurements

##### a) Digiscope

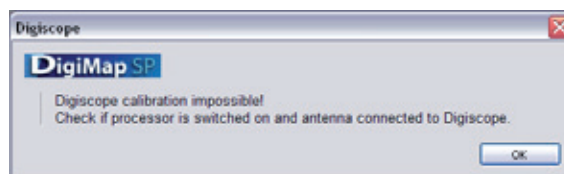
The Digiscope is shows the signals sent by the processor to the electrodes in response to sound.

This tool enables you to:

- Test a fitting by checking the stimulation levels of each electrode in real time.
- Test the integrity of the cable, antenna and microphone, and identify possible device problems.

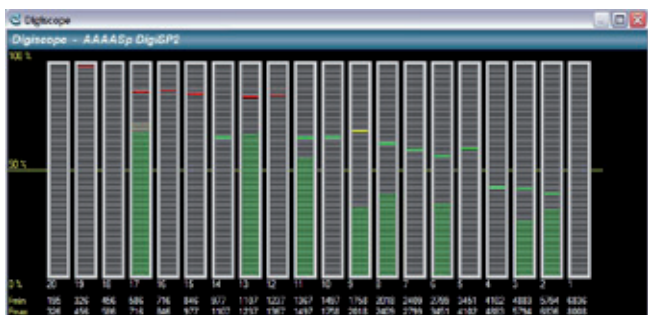
The Digimap SP USB interface includes a Digiscope sensor that is compatible with all Digisonic® and Digisonic® SP processors. To use the Digiscope:

- Hold the antenna on the interface as shown (note: there is no magnet in the Digibox)
- Open the Digiscope window by clicking on the shortcut (or the “Fittings/Digiscope” menu) from the Digimap SP software.



*Note:* If you cannot view the Digiscope, check the settings in the “Settings/Preferences/Ports” menu: make sure that the Digimap SP USB interface is selected.





The Digiscope window displays the active electrodes on the horizontal axis with their corresponding frequency bands. The saturation level, which is expressed as a percentage of the dynamic range (0 to 100%), is represented on the vertical axis.

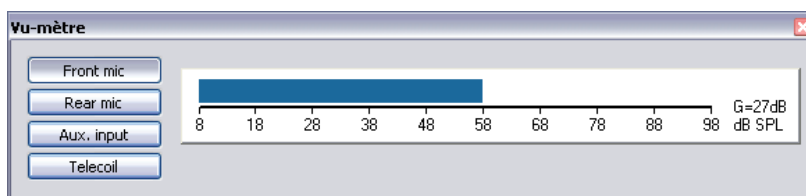
Speak at a normal volume and check the saturation level of all of the electrodes. Persistent saturation in the red zone can be attenuated by changing certain parameters (“Gains” parameters for the frequencies in question, thresholds, etc.).

*About the Advanced Digiscope:* Like the advanced talk over test, a specific window opens enabling you to change the denoising/analog gain/sensitivity level (depending on the processor generation), in order to assess the perceived sound level based on the position of the selector wheel.

## b) Vu-meter

The vu-meter is a tool which shows the real-time signal from either of the processor’s microphones (front and rear) or from any auxiliary device connected to the processor. This test does not require the participation of the patient and processor does not stimulate any electrodes during the test.

To start the test, click on the vu-meter icon in the left-hand column of the Digimap SP software so that the dialog box appears. Then select the microphone or aux input to view its level.



Depending on the type of processor connected, the scaling will be different:

- Positive scale from 0 to 100dB SPL for the processors:
  - Saphyr® SP and CX
  - Zebra®
  - Digi SP’K
  - Digi SP with LED that has been reprogrammed with DSP software version 2.2 or higher
  - Digisonic® BTE with LED that has been reprogrammed with DSP software version 1.6 or higher
- Negative scale from 0 to -90dB (dB relative to the full scale) for the processors:
  - Digi SP without LED
  - Digi SP with LED reprogrammed with a DSP software version below 2.2
  - Digisonic® BTE

During this test, it is preferable to hold the device or set it down 20-30cm from you. The level displayed generally varies between -50 and -40dB (negative scale) or 40-50dB (positive scale) in a quiet sound environment. Whistle or clap your hands to watch the variation in the level.

The following results may indicate that there is a problem with the microphone (microphone that is dirty, blocked, has moved, or is defective):

- Abnormal level in a normal sound environment (between -90dB and -60dB on the negative scale, between 0 and 60dB SPL on the positive scale)
- Little variation in the level when noise is made (whistling, clapping, etc.).

If this type of abnormality is observed, it is recommended to send the processor back to Neurelec’s Customer Service Department.

*Note:* In the event that a program has been configured with a “directional” microphone, it is important to check whether the front and rear microphones are functioning correctly using the vu-meter.

## 5) Tools Menu

### 5.1) Files Tools

#### a) Merge files

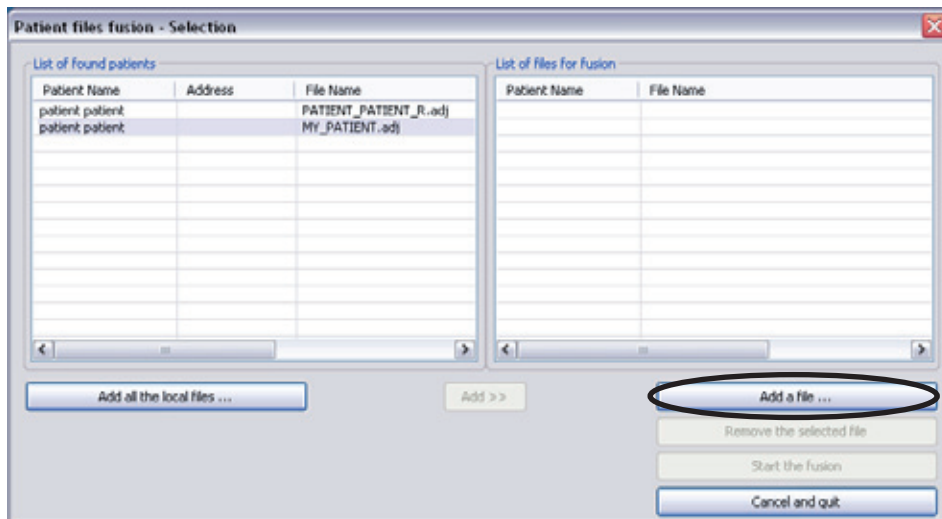
The Merge files function makes it possible to eliminate duplicate patient files in the local database (see the section entitled “Find duplicated files”, page 49). The function merges sessions from two similar patient files according to similarities between the identity cards.

It is recommended to merge all duplicate files that are found using the method described below.

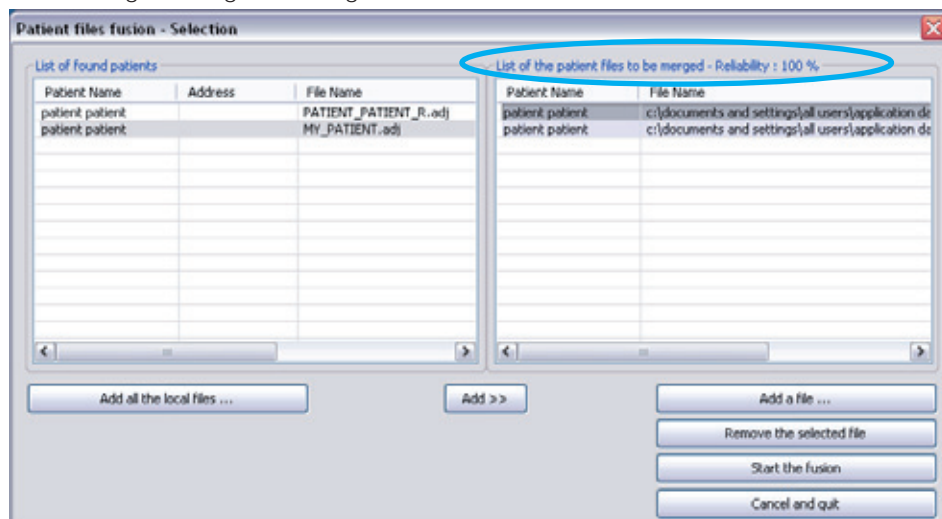
### Procedure:

- Go to the “Tools/Files Tools/Search the redundant patient files” menu.
- If the Digimap SP software indicates that duplicated files have been identified, the files merge window will automatically open. Otherwise, the procedure is finished.
- In the files merge window, the software automatically fills in the left-hand column with the files to be merged that were found while searching for duplicates. It is necessary to manually oversee the process one patient at a time to avoid errors.
- Select all of the files belonging to the same patient in the left-hand column using the “Add” button (purple circle in the picture below)
- The files to be merged will appear in the right-hand column

**Note:** It is possible to delete a file from the right-hand column by clicking on “Remove the selected file”



- A reliability index (blue circle in the following picture) will appear in order to prevent the user from merging files that should not be merged (for example, two different patients, or files from the left CI and right CI of the same patient):
  - If the reliability index is greater than or equal to 77%, the files may be merged
  - If the index is less than this value, the files are probably different (from different patients or from the same patient with 2 different implants) and the files cannot be merged.
- Next click on “Start the merge” to begin the merge



- A summary appears in order to make sure one last time that the files are really from the same patient
- Click on “Accept”

**Fusion - Validation de la carte d'identité**

**Identity**

Surname : patient  
 Firstname : patient  
 Address :  
 D.O.B. :  
 Gender : f  
 Phone :

**Implantation center**

Hospital :  
 Adjustmer center :  
 Contact Name :  
 Phone :

**Other informations**

Length of deafness : 0  
 Aetiology of deafness :  
 Remark :  
 The patient allows Neurelec to keep data adjustments :  
 Patient's speaker size (if the processor is electro-acoustic) : 2

**List of the merged processors**

Type	Serial Number	Microphone	Status
SAPHYR SP	31918		Current
SAPHYR SP	31113		Repair
SAPHYR SP	1120		Former spare
SAPHYR SP	1120		Repair

**List of the merged implants**

Type	Date	Ear	Serial Number	EA	Status
Digisonic SP	03/03/2010	Right	DR. 08 / K. 0001	20 Electrodes	Current

**Note:** If the software detects several active processors and/or implants (“current” or “spare” status), the following message will appear in order to select the right processor/implant.

**Fusion - Confirm the patient's identity**

**Identity**

Surname : patient  
 Firstname : patient  
 Address :  
 D.O.B. :  
 Gender : f  
 Phone :

**Implantation center**

Hospital :  
 Adjustment center :  
 Nom du correspondant :

**Define the current processor**

**DigiMap SP**

Please double-click in the list of the processors to define the current processor.

OK

**Warning:** Several precautions are taken to avoid merging files inappropriately. If the reliability index is less than 77%, but the files really are identical, it is still possible to resolve the problem by clicking on “Edit the identity card” for one of the two patient files and changing the fields so that the two files to be merged are as similar as possible.

#### b) Automatically renaming patient files

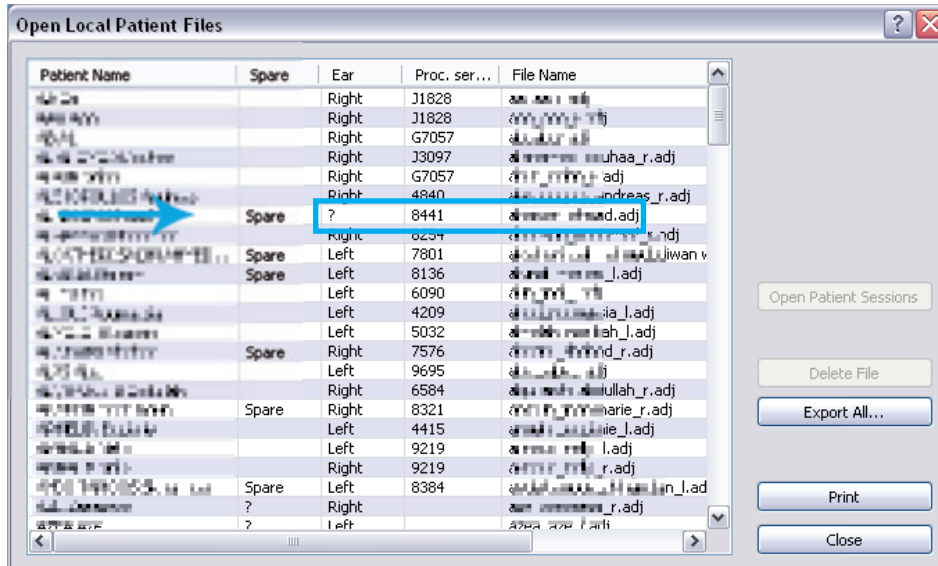
In order to avoid confusing patient files, particularly in cases of bilateral implantation, it is essential to specify the side that the cochlear implant system was implanted on whenever a new identity card is created.

Thus, any new patient file saved in the computer's local database appears as follows: Last name\_first name\_R.adj (R stands for Right for implantation on the right side) or Last name\_first name\_L.adj (L stands for Left for implantation on the left side).

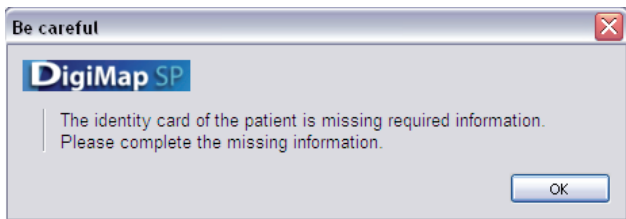
However, for patients who received their implant system before May 1st, 2010, the implant side is not specified in the name of the patient file. It is therefore necessary to update the existing database of patient files using the “Automatically rename patient files” function.

**Note:** In some cases, the implant side was not filled in by the user when creating the identity card. In this case, the “Ear” field in the is blank and is marked with an exclamation point. The “Automatically rename patient files” function cannot, therefore, update this type of patient file.

Side not specified



This type of file must be updated manually by the user. The software will automatically prompt you to do so when the file is opened. Click "OK" to access the identity card and fill in the missing fields.



If some of the information requested is unknown, particularly the implant's serial number and/or surgery date, the file can be populated at that time with a generic serial number and/or any surgery date in order to move forward with the fitting procedure.

### c) Finding duplicated files

The "Find duplicated files" function causes Digimap SP to automatically start searching for patient files in the local database that may be duplicates. The goal is to make it easier for the user to update the local database.

## 6) Settings Menu

The "Settings" menu allows you to change a number of parameters that are defined as user preferences in the Digimap SP software.

The options listed below are available in this menu. The most frequently used options will be presented further on in this document.

- Language: select the language to use in the software
- Stimulation: define the characteristics of the sound stimuli
- Ports: configure the ports according to the equipment that is being used for the fitting (interface, Digiscope)
- Files: configure the path for the removable storage media and patient files
- Digiscope: display parameters for the Digiscope sensor
- Internet: configure email settings



### 6.1) Stimulation

It is possible to change the stimulation type (sound stimulus used when testing thresholds, or during advanced stimulation).

By default, the software proposes intermittent stimulation. It is possible to define the duration of the pulse burst (Ton) as well as the duration of silence (Toff) between two pulse bursts.

It is recommended to keep the default values proposed by Digimap SP. However, slower stimulation may be indicated in specific cases (auditory nerve that fatigues easily, etc).

Lastly, it is possible to enable sound feedback in this window when testing thresholds and for advanced stimulation.



### 6.2) Ports

The Digimap SP software is compatible with the Digimap SP USB interface, which is automatically configured by default when the software is installed.

This software can also function with an older model of the interface that uses a serial port. In such case, the port settings must be changed in the “Ports” window.



It is also possible to change the settings for using the Digiscope tool (built-in sensor within the Digimap SP USB settings interface or connecting to the computer’s parallel port if it is an older model).

### 6.3) Files

The “Files” option enables you to define:

- Backing up files automatically to removable storage media at the end of the fitting session:
  - The patient’s Neurelec floppy disk
  - The patient’s Neurelec USB key
- The location of the storage media that the patient file will be automatically saved to at the end of the fitting session
- The backup location of the “Patients” file containing all of the patient files saved on the computer.



#### Using the Neurelec USB key:

A USB key is included in the Neurelec processor packaging and replaces the floppy disks that were previously provided for storing the fittings for each patient.

**If the user wishes to read and save the patient file to the Neurelec USB key** during each fitting session, it is first necessary to set the parameters in the “Files” window using the following functions:

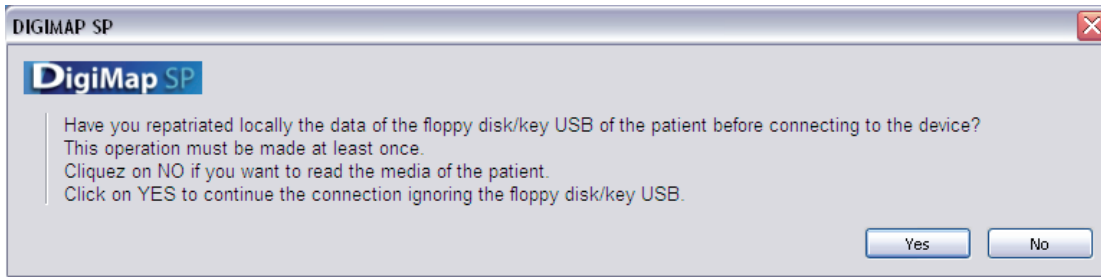
- “Record automatically the file of the patient file on the media below at the end of the fitting”
- “Use the Neurelec USB patient key”

#### *Important:*

For the first fitting, the patient’s Neurelec USB key must be synchronized with his/her processor. To do so, it is recommended to follow this procedure:

- Connect the processor
- Start the connection
- The following message appears: click NO





- The USB key, which should not have yet been connected to the computer, must now be connected to a USB port. Then click OK.
- Unplug and click OK.
- Plug in again and click OK.
- 

The key is now identified and works properly.

This synchronization operation only needs to be carried out once.

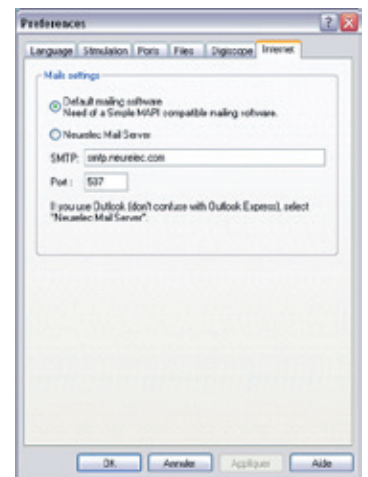
During each fitting session with the patient, it will be necessary to merge the USB key's data with the data saved locally because the patient files could potentially be different (example: the patient went for a follow-up visit in another implantation center).

To do so, just click NO when the window above appears (see the section entitled "Merge files", page 45).

#### 6.4) Internet

The "Internet" tab allows you to set email settings by choosing either a local email software program or Neurelec's remote mail server.

If the Neurelec mail server is used, the default parameters do not need to be changed. However, it is necessary to make sure that port "587" is not blocked by the firewall of the network being used.



#### 7) Help Menu

The "Help" menu, and more specifically the "About" option, provides the user with information about the DigiMap SP software version being used.

This information is particularly important for resolving connection problems caused by using an outdated version, for example.

On-line help will be available soon.



## II. FITTING PROCEDURE

*Important:* The rest of the document presents the generic steps for a typical fitting session when using a **Saphyr® SP processor**. Fitting instructions for the other generations of Neurelec processors (Saphyr® CX, Zebra®, Digi SP'K, Digi SP, Digisonic® BTE and Digisonic® BW) are available in the “Appendices” section of this manual.

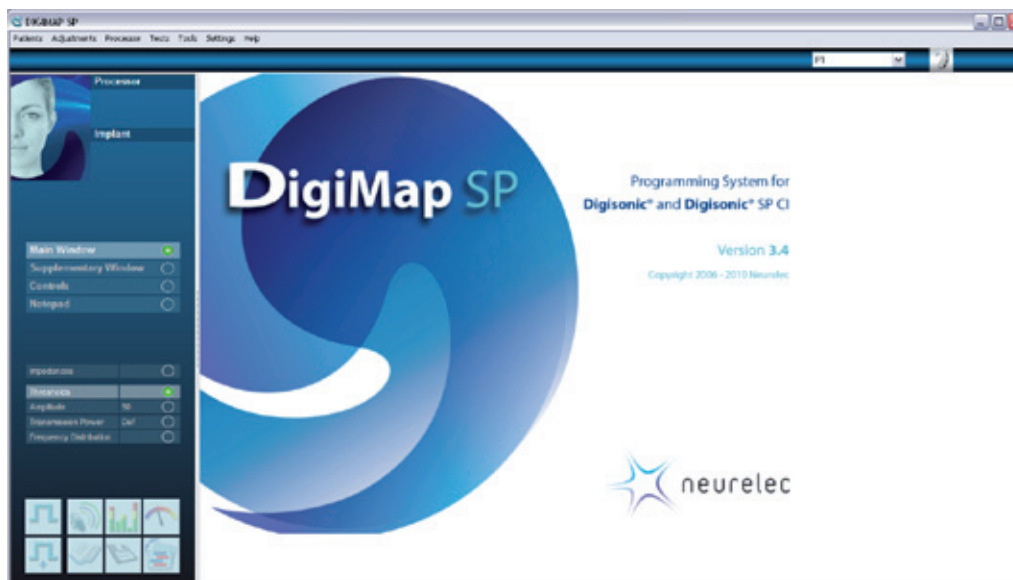
Before connecting a processor, the Digimap SP USB settings interface must be correctly installed and recognized by the computer. To do so, refer to the instructions that come with the Digimap SP USB interface. The green light must be constantly on.

When using the Digimap SP software for the first time, a personal user account must be created by clicking on “Create a new user” (see the section entitled “Logging in as a user”, page 20).

When the personal user account has been created, the login window will appear on screen. This window is displayed whenever the Digimap SP software is opened. Enter the information in the login window, then click “Enter”.



The main window of the programming system is now displayed.



### A. Connection

Connected the processor by following the procedure below:

- Remove the processor's batteries
- Turn on the processor by turning the selector wheel to position 1, 2, or 3
- Plug the interface's programming lead into the processor's programming socket. Warning: the programming lead used to connect to a Saphyr® is not the same as the lead used for the Digi SP processor (see the instructions for using the Digimap SP USB interface)

- Start up the Digimap SP 3.4 software
- Click “Processor/connect” or use the shortcut F12. Warning: Connecting a processor should not be done while the processor is attached to the patient!

*Note:* If you do not begin by connecting a processor, you can still look up and open an existing patient file or create a new one. It is sometimes useful to create a patient file before the patient arrives.

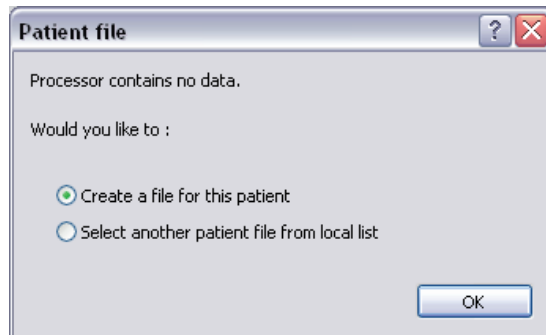
Different situations may occur when connecting a processor.

## 1) Unprogrammed processor

### 1.1) Patient file not saved in the computer (first fitting)

For the first fitting, if the processor is new and the patient file does not exist in the local database, the software prompts you to create a new patient file upon connection.

Simply click on “Create the file for this patient” to open a new identity card to fill out. After confirming this card, the corresponding patient file is automatically generated and the processor can now be set.



### 1.2) Patient file saved in the computer (maintenance or pre-fitting)

In order to make the Digimap SP software easier to work with and to standardize the connection procedures, the most difficult case to deal with (loading a patient file to a processor that is already programmed with another patient file during maintenance) is done easily by following these steps:

- Connect the processor and clear it of its contents (go to the “Processor/Reinitialize the processor” menu. After re-initialization is complete, the processor is automatically disconnected.
- Reconnect the processor (now empty) and click on “Choose a patient from the list of local files” to select the desired patient file from the list and load the desired fitting session from the history.

When managing patient files and particularly for routine tracking of the various systems used by the patient (implant or processor), the message shown on the right appears to provide information about the status of the patient’s usual processor.

This window enables you to enter information about the status of the new processor that has been connected (e.g. a spare or a permanent exchange) as well as the status of the patient’s usual processor (sent in for repairs, or temporarily or permanently declassified).

This information is then automatically copied in the patient’s identity card. Any change of processor is also specified using the system’s serial number, which is indicated in the “Processor” column of the patient sessions history.



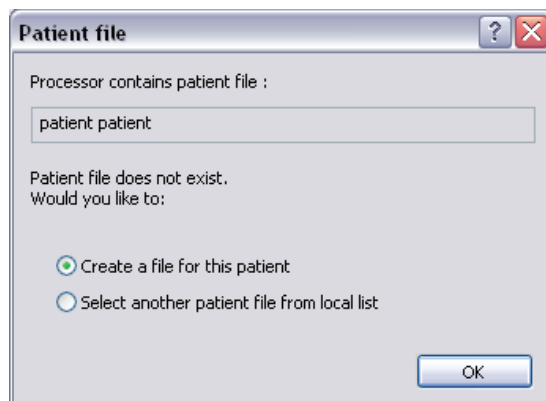
## 2) Processor that is already programmed

### 2.1) Patient file not saved in the computer (new PC or change of center)

If the patient file programmed in the processor does not already exist in the local database, the software can read the patient data that is stored in the device and create a corresponding local patient file for you.

By clicking on “Create the file for this patient”, the software automatically displays the identity card containing all of the information from the processor.

Simply validate the card to create the patient file in the computer’s local list and begin the fitting session.





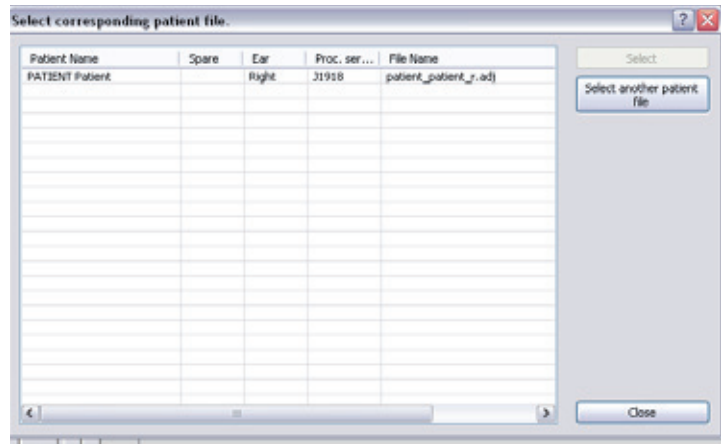
## 2.2) Patient file saved in the computer (standard fitting)

During a standard fitting, the patient's data is read from the connected processor.

The computer determines which patient file is associated. The user then just needs to select this patient file in order to start the fitting session.

It is also possible to get the following information: whether the processor being used is a spare device, the processor's serial number, and the name of the corresponding patient file.

*Note:* During maintenance, it is recommended to use the simplified procedure described above by selecting the "Choose another patient file" function in the window.



## B. Reprogramming

At the end of the connection process, the software offers to reprogram the processor if the DSP (Digital Signal Processor) software version is not up-to-date. Reprogramming gives the audiologist access to new fitting features and allows the patient to benefit from technological advancements. The version suggested by the software depends on the type of processor connected (Saphyr®, Zebra®, Digi SP, Digisonic® BTE).

It is possible to decline reprogramming and update this later from the "Processor/Update Digisonic® software" menu. However, it is recommended to always reprogram the processor when prompted to do so.

## C. Fitting parameters

### 1) Main Window

#### 1.1) Impedances

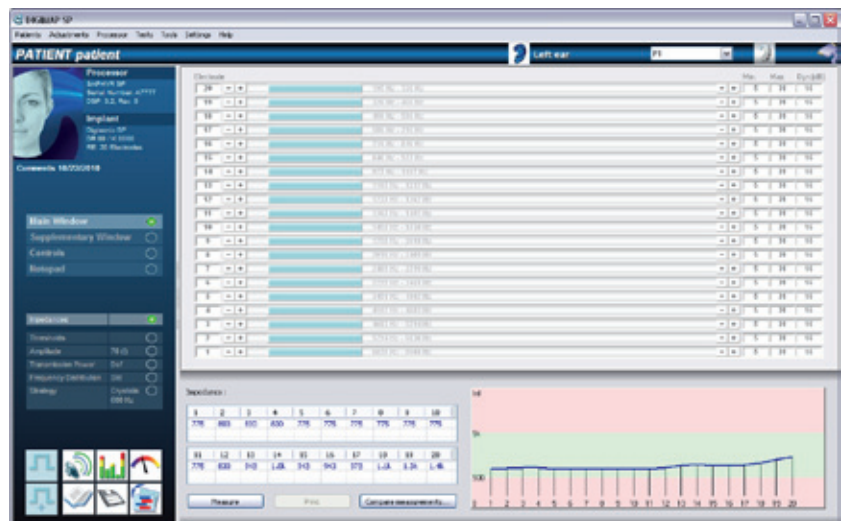
The impedance measurement measures the resistivity between the electrode and its surrounding environment. This enables you to make sure that the internal part and electrodes are functioning correctly and that the electrode/tissue contact is good to ensure the electrode-array is completely inserted in the cochlea.

This measurement, which was previously only available in the Digistim SP software, is now possible for the Saphyr® SP generation of processors with Digimap SP version 3.4.3 (available for Digi SP'K processors using version 3.2 or higher). Simply click on the "Impedances" parameter in the main window, then start the measurement by selecting "Measure".

During the measurement, the patient must wear the processor with the antenna in place in order to make sure that it is communicating with the internal part.

If the impedance measurement fails, follow these instructions:

1. Make sure that the external component is positioned correctly, particularly the antenna, which should face the implant. After checking the positioning, try the measurement again
2. Carry out the test with spare external components (processor, antenna, coil)
3. Perform the test with the Digistim SP USB system and its Digistim SP software
4. If, after all of these steps, the impedance measurement still cannot be carried out, it is recommended to contact your Neurelec clinical support contact or Neurelec's Customer Service Department.



You can compare "Impedances" from the current measurement to previous ones. Simply click on "Compare measurements" and select the historical measurement you want to compare with from the list provided.

## Note:

- Click “Print” to print a copy of the current impedances. Note: you can also print these values from a fittings along with other information recap by going to the “Fittings/Print the fittings” menu.
- Measuring impedances is available for Saphyr® SP, Zebra® and Digi SP’K processors, it is not available for other processors, including Digi SP’K cx.

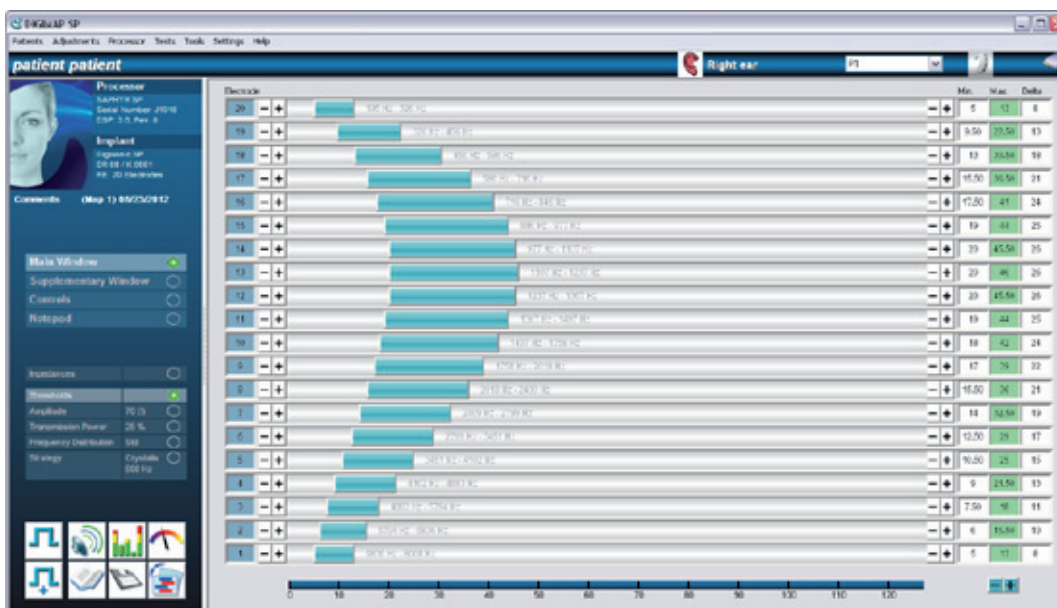
### 1.2) Thresholds

The Thresholds window shows current electrical threshold values (Min. column) and comfort values (Max. column) for each active electrode. These values are graphically represented as a horizontal bar with Min. as the left edge and Max. as the right. The last column on the right-hand side calculates the dynamic range in dB. It is calculated as the ratio between Max. and the Min. expressed in dB.

Min. and Max. values are expressed in  $\mu\text{s}$ , and can be changed in intervals of  $1\mu\text{s}$  over a range between 1 and  $120\mu\text{s}$  (in some special cases, the maximum duration can be greater than this).

The frequency band attributed to each electrode is displayed next its bar.

Each numbered line corresponds to an electrode. Electrode 20 is the most apical electrode (for low-pitched sounds) and electrode 1 is the most basal. At the beginning of the first fitting, all of the electrodes are disabled and greyed out.



### About the dynamic range:

The dynamic range is expressed in dB and calculated as the logarithm of the ratio of the Max. to Min. thresholds. It is useful to assess the patient's ability to discriminate between different intensity levels.

Electrical dynamic ranges vary depending on the patient. In general, the dynamic ranges of the basal electrodes (electrodes 1 through 5) are narrower. And the shape created by the dynamic ranges of all of the electrodes shows the widest dynamic ranges in the middle of the electrode-array. Dynamic range generally increases during the first few months after implantation.

### a) Procedure

#### Enabling/disabling electrodes

At the start of the first fitting, all electrodes are disabled and greyed out. Some electrodes must be enabled to proceed. Only the intracochlear electrodes should be enabled so please consult the surgical report to determine which electrodes to enable.

To enable (or disable) a single electrode, double-click on its number or select the number and press the “Ins” key to enable the electrode (“Del” to disable it).

To enable all electrodes at once, press the CTRL+E keys.

An electrode may be disabled in the following circumstances:

- No sound sensation
- Sensation that is not sound (stimulation of the face or vestibular effects)
- Unpleasant sound sensation (patients who have suffered from hearing loss for a long time)
- Unstable sensation, no Max. thresholds

## Changing the thresholds

During a fitting, the Min. and Max. thresholds can be changed as follows: use the mouse to click the + and - buttons for the electrode in question, or press the left and right arrow keys.

The "Enter" key allows you to toggle between adjusting the Min. threshold value and the Max. value.

Hold down the SHIFT or CTRL button while selecting the desired electrodes (then double-click on the Min. or Max. column heading) to change all of the thresholds of a group of electrodes at the same time.

It is possible to change all of the Min. or Max. thresholds at once by double-clicking at the heading (Min. or Max.) of the corresponding column. The change is then applied to all of the electrodes simultaneously.

It is generally recommended to set the Min. threshold at the "Barely audible" level described by the patient, and the Max. threshold at the "Loud but Comfortable" level.

- If the dynamic range is too wide for all of the electrodes, increase the intensity (see the section entitled "Intensity", page 63) and readjust the thresholds. Warning: always lower the Max. thresholds before stimulating the patient.
- If the dynamic range is too narrow after several fittings, decrease the intensity and readjust the thresholds.

## Stimulation

The thresholds are determined for each electrode by stimulating that electrode. Stimulation can be started using the shortcut icon for it in the software or using the F2 key.

It is possible to continue changing a threshold during stimulation by using the displayed + and - buttons (or the left and right arrows), but only those buttons. Using any other button will stop stimulation.

The frequency of the sound feedback for the audiology during testing reflects the frequency for the patient defined in the fitting parameters.

Furthermore, in the Settings/Preferences/Stimulation menu, it is possible to change this calibrated stimulation (continuous or intermittent stimulation, and sound feedback for the audiologist). The system uses intermittent stimulation by default.

### b) Suggestions for use

## Method for adjusting thresholds in children

### Preliminary precautions:

The child and his/her family should be present and well-informed. The audiologist should have the patient file and the surgical report to ascertain if there are any extra-cochlear electrodes which should not be enabled at switch on. The speech therapist who will handle the child's after-care should be present.

### First things to do:

- The Digimap default parameters should be used as a basis, particularly for anything relating to items in the supplementary and strategy window.
- The transmission power must be measured and set, a typical value is 5% (and not more than 30% for Saphyr SP)
- An impedance measurement will ensure the internal part and all the electrodes are working properly.
- "Enable all electrodes" by using the Ctrl+E shortcut (be sure to consult the surgical report to determine if any extra-cochlear electrodes exist which should be disabled)

### Testing Max thresholds

- Stimulation by group of electrodes
  - The goal is to quickly define the child's Max thresholds.
  - Maximum of 5 electrodes per group
  - Electrode groups are presented in the conventional way (see clinical audiometry)
    - 15-11
    - 10-6
    - 5 to 1 (the basal electrode group)
    - 20 - 16
  - Define the selection area (Shift+G) – (red circle)
  - Double-click the Min or Max area (shown in green).

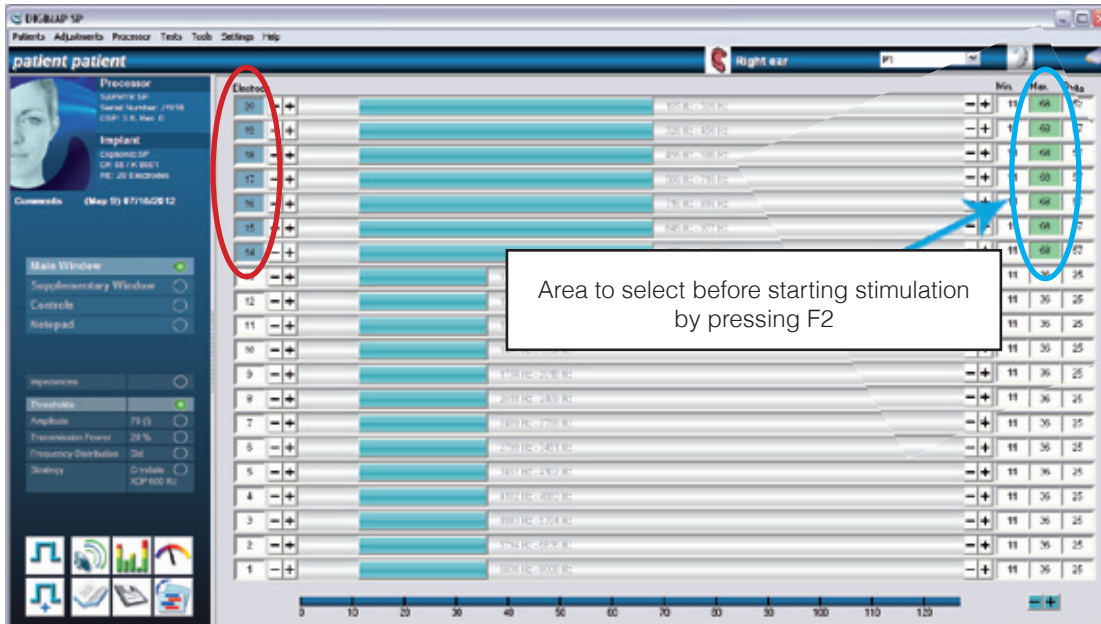


Figure 1: stimulation by group

- Press F2 or the Spacebar to begin stimulation
- Test the comfort thresholds (Max)
- Each group of electrodes is stimulated together. This is indicated by flashing the horizontal bars of all grouped electrodes together (yellow circle)
- The perceived loudness when stimulating a group of electrodes together will be louder than when stimulating a single electrode alone (summation effect).

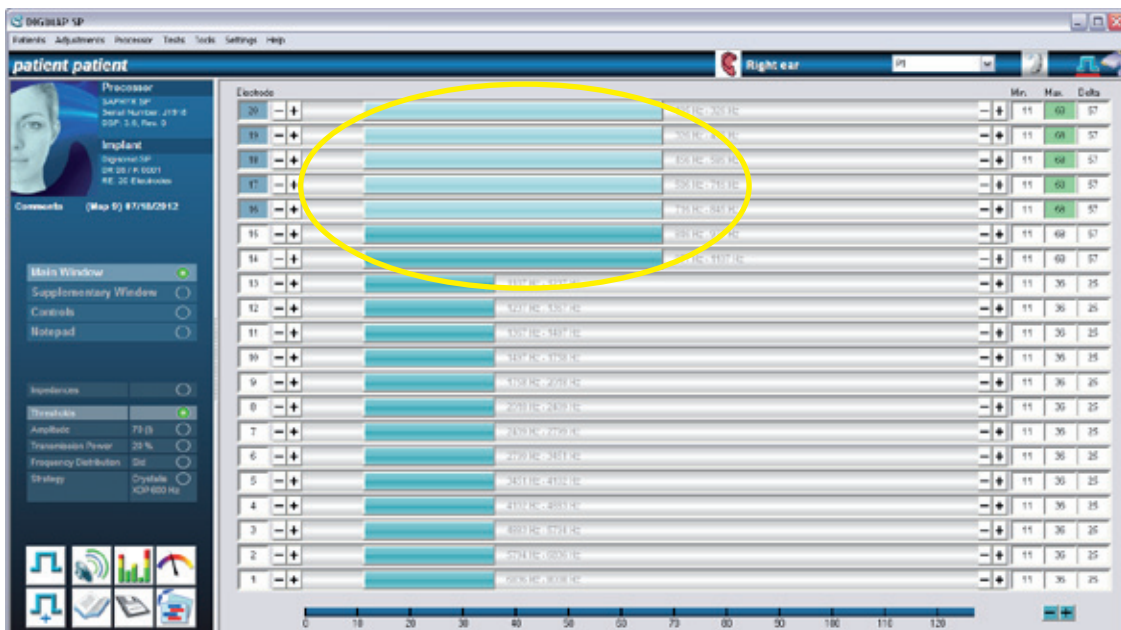


Figure 2: stimulating an electrode group

### Interpolation function

Once the Max. thresholds of the 4 groups of electrodes has been determined, an interpolation creates a smooth profile across all enabled electrodes.

### Procedure:

- Define the Comfort thresholds (Max. levels) for the 4 sets of electrodes
- Select the following electrodes by pressing Ctrl+G
  - E20
  - E13
  - E7
  - E1 (or the most basal electrode)

- Use the interpolation function (Fittings – Duration of stimulation – Interpolate) (Ctrl+O) = to apply the interpolated smoothing across electrodes.



Figure 3: interpolation of the MAP

### Automatically estimating the Min thresholds

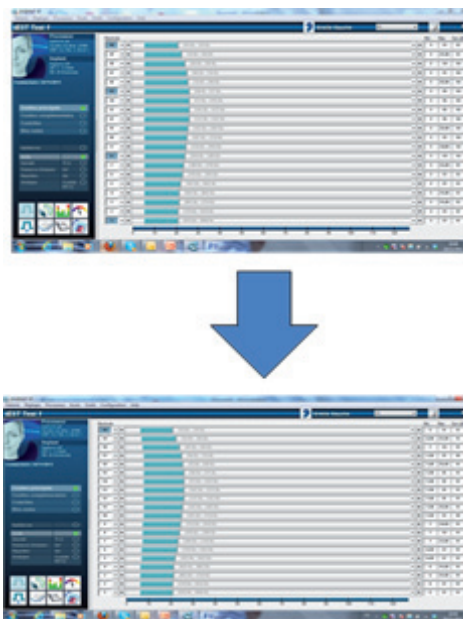
It is often difficult to determine the Min thresholds for children. The Min thresholds can be automatically adjusted to 30% of the Max levels by:

Click the function “Estimate Min thresholds” (Fittings – Duration of stimulation – Estimate Min thresholds) - (Ctrl+M)

A confirmation message will appear

Accept

The Min thresholds are now set to be 30% of the of the Max threshold levels



### Confirmation before talk over testing

To avoid over-stimulation during the first talk over test, it is recommended to use the advanced stimulation function at 100% and 120% of the Max thresholds. If no discomfort is observed at 120% it is safe to proceed to the talk-over test.

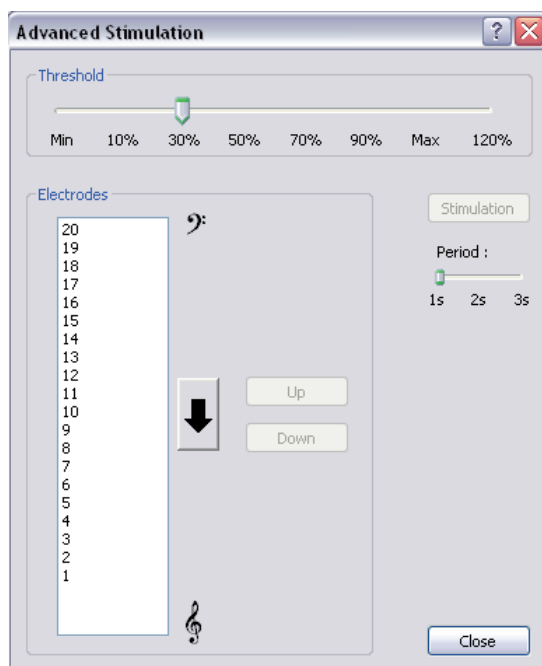
An advanced stimulation test should also be done to evaluate the perception of sounds at low levels, so tests at 50% (or even 30% and 10%) can be carried out to determine whether the fittings are effective.

### About advanced stimulation

Advanced stimulation makes it possible to check whether the loudness of each electrode is balanced correctly with other electrodes, thus enabling you to check the threshold fittings that were previously made.

Hold down the SHIFT and CTRL keys to select a group of electrodes, then choose the desired level of stimulation (expressed as a percentage relative to the Max level). Click on “Stimulation” to start a sweep of the selected electrodes. The patient must then indicate the perceived level of these electrodes, with the goal being to obtain the same sound level. If one electrode stands out as having a level that is too low or too high, return to the Thresholds window and manually adjust that electrode.

Click on the arrow to switch the order of stimulation (low- to high-pitched electrodes, or the reverse).



**Talk over test:**

For safety reasons, it is necessary to lower the intensity by 2 units and allow the child to relax and engage in a fun activity. It is also essential to maintain silence in the fitting room. During the talk over test, various things will be evaluated:

- Verifying detection
  - Generating small sounds at low to medium intensity levels (e.g. voice, calibrated objects that make sounds)
- Verifying high intensity perception
  - Toys that make intense sounds
- Verifying pitch
  - low notes / high notes

**Method for setting thresholds in adults**

Using patient feedback efficiently can speed up the fitting process, the following approach is a preferred and faster method to get to the proper MAP:

- Stimulate the electrodes in groups until the patient describes a weak sensation (Min threshold) for each group as well as a comfortable sensation (Max threshold) for each group
- Electrode groups are presented in the conventional way (see clinical audiometry)
  - 15-11
  - 10-6
  - 5 to 1 (the most basal electrodes)
  - 20 to 16
- Once the Min. and Max. thresholds are obtained for the 4 electrode groups
  - Interpolate (Ctrl+O)
- An initial MAP is created
- Use advanced stimulation to control the Max thresholds at 100%, 120% to avoid over-stimulation on first talk-over
  - Adjust the electrodes one by one if necessary
- Talk over test
- Adjust the overall volume using the intensity level based on the patient's feedback



**Figure 5: interpolation of Min and Max thresholds**

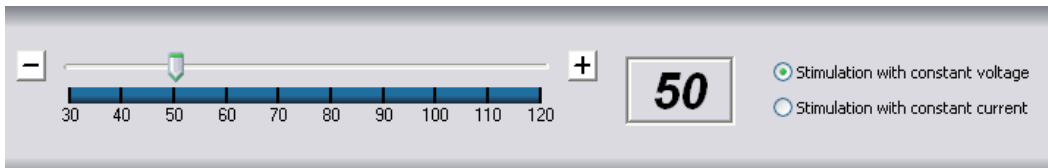
*In summary:* the shortcuts

Action	Keystrokes	Mouse actions
Enable/disable an electrode	Use the "Ins"/"Del" keys	Double-click the electrode number
Select the previous/next electrode	Up and down arrows	Click the electrode number
Select several electrodes (consecutive or non-consecutive)	Hold down the SHIFT key and select the electrodes using the up or down arrow keys	Hold down the SHIFT or CTRL key and select the electrodes by clicking on the desired electrode's number
Increase/decrease the threshold value	Use the right and left arrows	Click the + and - buttons on the right and left side of the electrode
Switch between the Min./Max. thresholds	Press the "Enter" key	Click the + and - buttons corresponding to the threshold that is being tested
Start/stop stimulation	Use the F2 shortcut or the space bar	Click the stimulation shortcut

### 1.3) Intensity

Intensity corresponds to the global amplitude shared by all electrodes, and may be adapted to each patient during a fitting session. Any change to this parameter may have an impact on the threshold values. It is therefore important to adjust the intensity before proceeding to adjust the Min. and Max. thresholds.

The intensity value is expressed in Machine Units (MU) and can be changed by intervals of 1 MU between 30 and 120 MU.



The window also allows you to select the stimulation mode:

- Current mode (default): the current is constant and the voltage varies according to the impedance.
- Voltage mode: the voltage is constant, the current varies according to the impedance.

#### a) Procedure

- Choose the stimulation mode (the default stimulation mode is the current mode).
- Adjust the intensity value. A default value is automatically given for all activations. This value depends on the stimulation mode selected and corresponds to the recommended minimum value:
  - Default value in current mode: 70
  - Default value in voltage mode: 50

The intensity value can be changed using the left and right arrow keys or the – and + buttons displayed on the screen. For safety reasons, the intensity can only be changed by intervals of one 1 MU (machine unit) at a time.

#### b) Suggestions for use

#### Stimulation mode

It is recommended to keep the current mode, which is selected by default unless fittings for the patient are changed, requiring this setting to be readjusted.

The default intensity value is 70 MU (current mode). It is possible to change this value during the fitting session with the patient, particularly when changes in the Min. and Max. thresholds require to do so. It is better to have a fairly wide electrical dynamic range (20 $\mu$ s) in order to have as many levels of loudness as possible.

#### Intensity

It is recommended to modify the intensity in the following cases (in reference specifically to the dynamic range of middle electrodes):

- Decrease the global intensity value if the dynamic ranges are too narrow (less than 10 $\mu$ s) or if the Min. thresholds of all electrodes are too low (below 7 $\mu$ s) and the levels have already stabilized (generally 6 months after first fitting).
- Increase the intensity value if the dynamic ranges of all electrodes are too wide (more than 60 $\mu$ s) or if the Max. thresholds are too high (above 100 $\mu$ s) this will help reduce battery consumption.
- 

The intensity should be adjusted before setting the Min. and Max. thresholds. If the intensity value is significantly modified during the fitting session, the Min. and Max. thresholds must be re-adjusted and the Max. thresholds must be lowered before stimulating the patient.

Warning: any significant change in intensity will cause a noticeable change for the patient. We suggest that you save the old fittings in another program.

#### For the first fitting

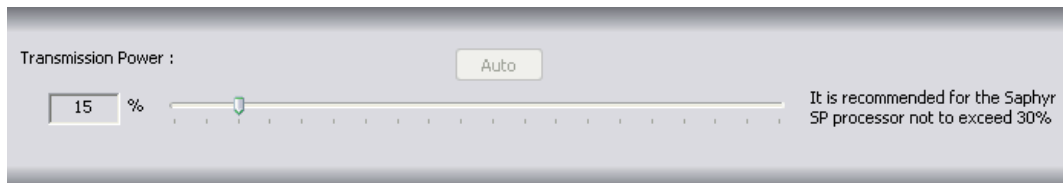
Make sure that all electrodes have a Min. threshold that is greater than 5 $\mu$ s and less than 60 $\mu$ s.

### 1.4) Transmission power

Transmission power represents the energy sent by the processor, which is needed to power the implant and make it function correctly.

The transmission power value is expressed as a percent (%) and can be changed by intervals of 1% between 5% and 100% (the minimum value, 5%, corresponds to the minimum level of transmission power that can be sent by the processor).

Transmission power depends on many parameters, particularly the thickness of the skin. After implantation, the thickness of the skin between the antennas usually stabilizes 4 months after the operation. It is therefore likely that this parameter will need to be lowered during the first few months after surgery.



#### a) Procedure

A default value (15%) is automatically given for all activations.

#### Automatic fitting

The Digimap SP software offers to automatically adjust the transmission power value. This makes it possible to apply the most appropriate value to avoid excessive battery use (due to poor battery life, power cutting out in a noisy environment, modifying the loudness according to the sound environment) or not enough power (poor power supply to the implant, inconsistent threshold settings).

It is therefore recommended to click the “Auto” button. The transmission power is then automatically calculated.

#### Manual fitting

It is also possible to adjust the transmission power manually using the left and right arrow keys or by moving the cursor with the mouse. However, it is strongly recommended to use the value proposed by the software after calculation.

*Note:* For Saphyr® SP and Digi SP'K processors, it is no longer necessary to remove and reconnect the antenna, as is the case for Digi SP processors. Simply click on “Auto” to start the measurement, which automatically occurs by communicating with the patient's implant. This cannot be done with the Digi SP'K cx processor.

#### b) Suggestions for use

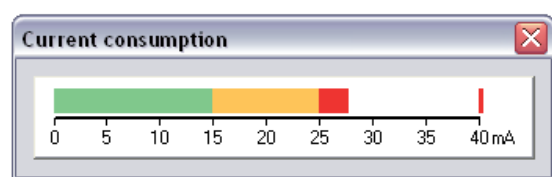
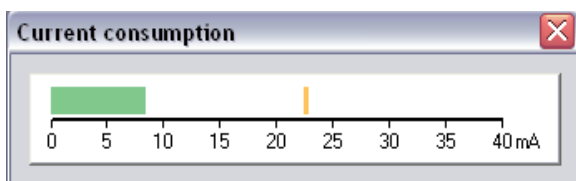
It is recommended to automatically adjust the transmission power, especially for the first fitting. The patient may eventually sense a slight decrease in volume, which can be compensated by increasing the intensity by one machine unit.

It is better to carry out this measurement at the very beginning of the fitting session.

The processor's current consumption can then be checked at any time during the fitting session (after adjusting the thresholds) by starting the talk over test. A bar graph displays the average amount of current used. The colored display makes it possible to distinguish between the different levels:

- Green: normal current consumption level, working properly
- Orange: high current consumption level
- Red: excessive battery use: great risk of short battery life or intermittent power

The maximum current consumption level is also displayed for information purposes as a vertical line in the current consumption window.



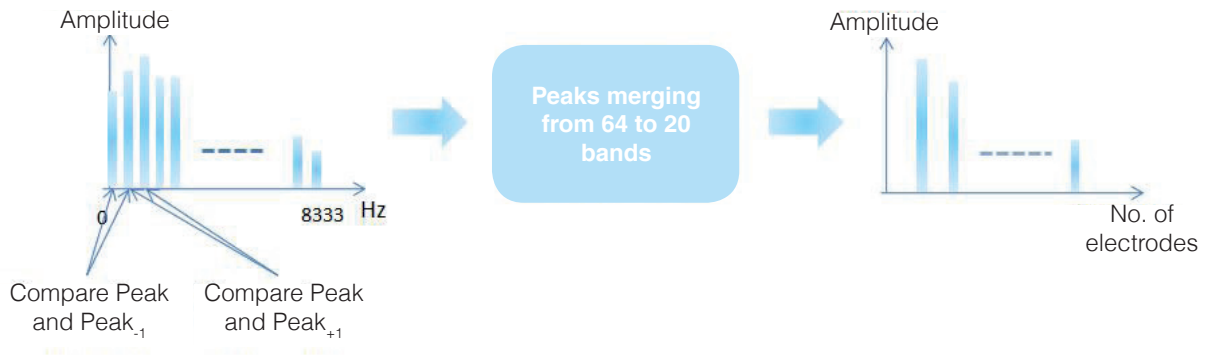
High levels of current consumption are rare for Saphyr® SP and Zebra® processors. However, excessive battery use may be detected, particularly if transmission power has been manually adjusted.

If this occurs, it is essential to manually decrease the transmission power value while using a talk over test to make sure that the level of loudness is satisfactory, or to change the other parameters that might be causing excessive battery use (elevated Max. thresholds, denoising value, high number of active electrodes per frame, stimulation frequency).

#### 1.5) Frequency distribution

Frequency distribution represents the band of frequencies associated with each active electrode. This makes it possible to merge the 64 bands obtained using FFT into 20 values.

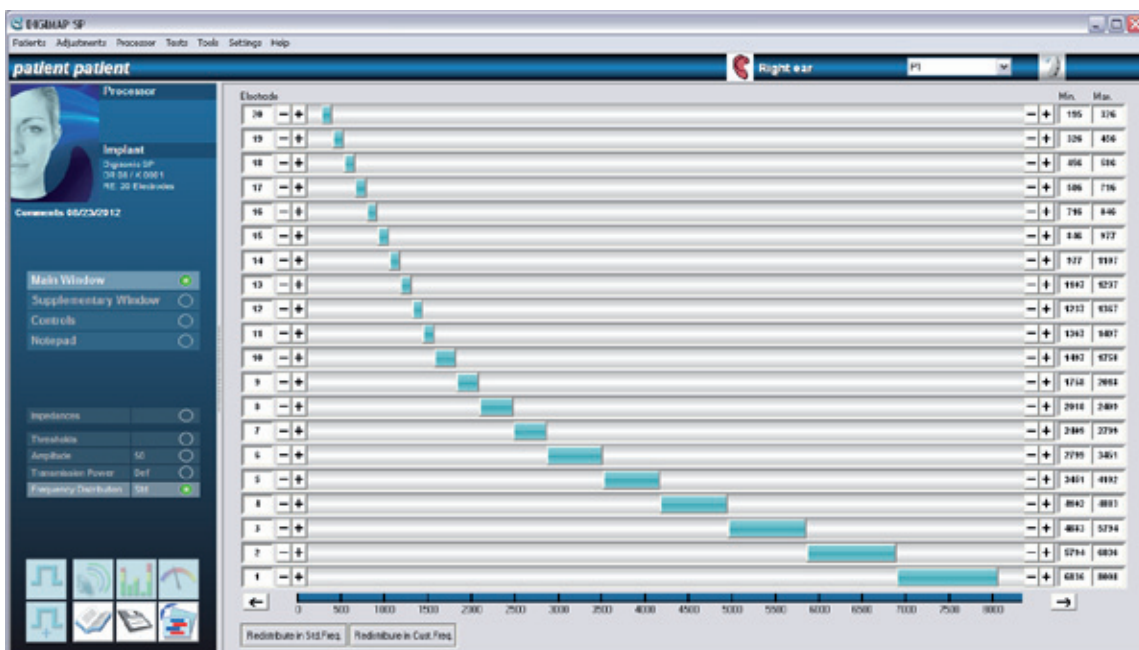




The displayed frequency value is expressed in Hertz (Hz) and can be changed by intervals of 122Hz or 130Hz depending on the processor generation.

Each electrode is represented horizontally like in the Thresholds window.

The right-hand columns indicate the Min. and Max. frequencies of the assigned band. This frequency band is also represented graphically by a horizontal bar whose left and right ends correspond to the Min. and Max. values shown.



The frequency distribution can be adapted automatically, manually, or it can be customized (semi-automatic).

The default distribution (“Standard distribution”) is applied linearly to the low frequencies and logarithmically to the high frequencies in order to get as close as possible to how the cochlea normally functions (Bark Scale). This is the type of distribution that should be applied in the vast majority of cases.

The “Redistribute in Cust. Freq.” button allows you to change advanced parameters (see the section below)

a) Procedure

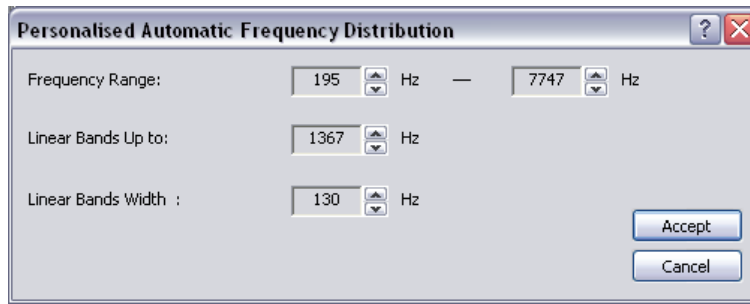
**Standard distribution**

A default distribution is automatically given for all activations. This representation is both linear and logarithmic and falls within a wide bandwidth. This bandwidth may vary slightly depending on the processor type (see the table below).

The “+” and “-” buttons on either side of the screen enable you to use the mouse to adjust the Min. and Max. values for a selected electrode. These values can also be changed using the left and right arrow keys. Each electrode can receive a range of frequencies that is within the total bandwidth of the microphone. The “<-” and “->” arrows at the bottom of the screen shift the entire frequency distribution by intervals of 122Hz or 130Hz, depending on the processor generation.

**Customized distribution**

The window displayed allows you to set additional parameters for the frequency distribution, namely the Min. and Max. values of the total bandwidth, the boundaries of the linear range, and the width of the bands in the linear range.



b) Suggestions for use

**Disabling electrodes**

The audiologist may have to disable electrodes during the fitting.

- When disabling a single electrode and/or when disabling an electrode less than 6 months after surgery, it is recommended to keep to the standard proposed frequency distribution.
- If the implanted patient is stable, disabling one or several electrodes requires careful attention in order to limit any possible discomfort that the patient might experience. The system will offer to automatically readjust the frequency distribution according to the number and location of the electrodes to be disabled. If automatic distribution is not possible, then the software will recommend that the distribution be carried out manually. To do so, it is necessary to fill the gap in the frequencies created by disabling electrode N by changing the distribution of the frequency bands of the neighboring electrodes N-1 and N+1.

• **When disabling multiple electrodes**, it is strongly recommended to contact Neurelec clinical support.

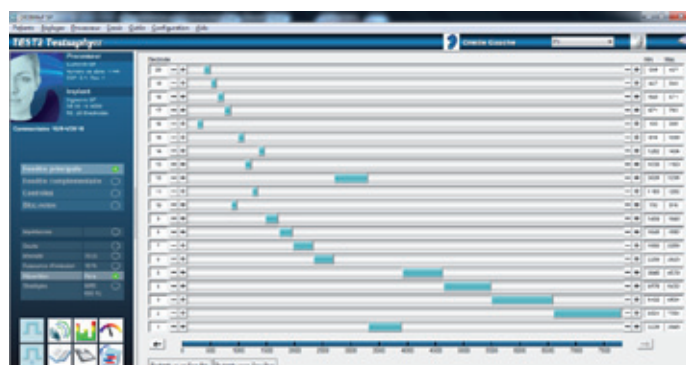
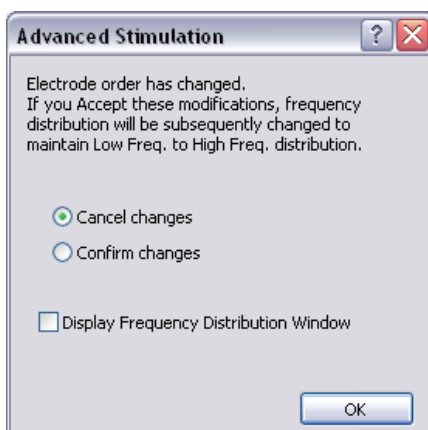
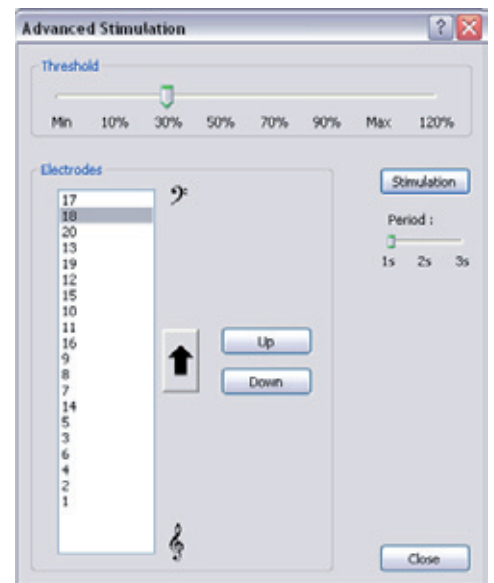
In some special cases (for example, with the Digisonic® SP ABI for brainstem implantations), it may be necessary to change the frequency distribution of the electrodes, or even to reverse the order of the frequency bands. To reverse the order of the electrodes, it is necessary to use the “Advanced Stimulation” function (shortcut in the column) in order to establish a frequency distribution that coincides with the patient’s tonotopy.

**About Advanced Stimulation – Tonotopic reversal**

The “Advanced Stimulation” window enables you to perform an electrode sweep in order to balance the sound level. It also makes it possible, particularly during specific fittings, to change the order of the electrodes in order to assign the patient a new tonotopy.

The basic approach of the test is to compare the frequencies perceived between two different electrodes. The electrode order is usually displayed in the advanced stimulation window going from top to bottom, from the lowest pitched electrode to the highest pitched electrode. If the comparison between the two electrodes does not match up with this predefined order, then it is necessary to reverse their positions. In such case, use the “Up” or “Down” buttons to change the position of the selected electrode.

When all of the electrodes have been tested and any necessary changes made, close the advanced stimulation window. The system then displays a dialog box that allows you to confirm the changes made and directly display the new frequency distribution if applicable.



## 1.6) Programming strategies

The programming strategy used in the processor defines the way that information is sent to the implant and distributed among the active electrodes. It defines the stimulation frequency that is applied to each stimulation frame.

Neurelec's recent technological developments in the field of signal processing have made it possible to include new programming strategies for the latest generation of processors.

### Crystalis

This programming strategy is based on the same concept as the strategy used for Digisonic® and Digisonic® SP processors. However, several improvements have been made:

- Clearer sound, even at low intensities
- Flat audiogram which is comparable to that of a normally hearing person
- Control of the amount of information sent
- Limited electrical interactions (diaphony)
- Improved reduction of background noise

#### a) Procedure

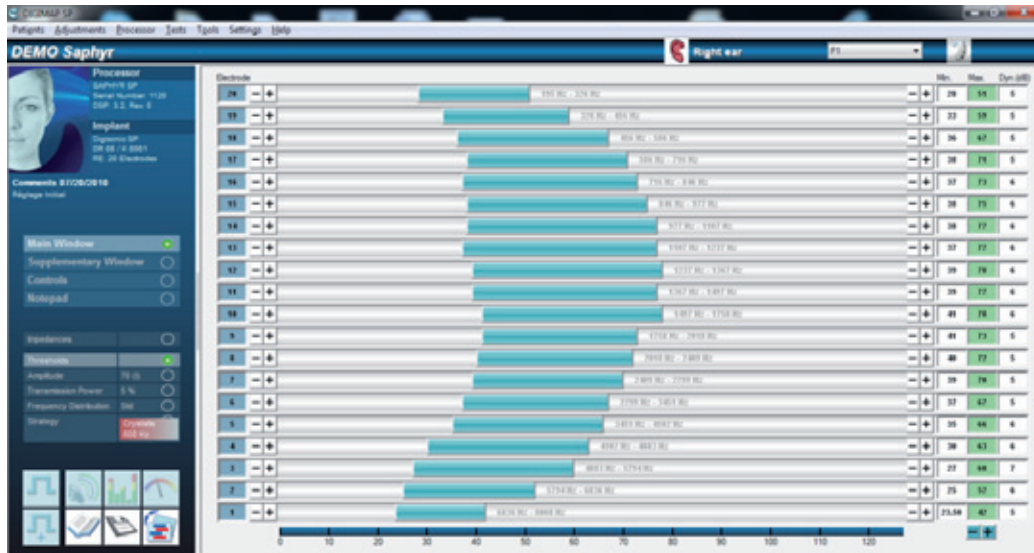
A default value of 600Hz is automatically given as the stimulation frequency for all activations. This is a recommended value, but it may be changed by using the left and right arrow keys or by moving the cursor displayed on the screen.

#### b) Suggestions for use

For the first fitting, the default value given for stimulation frequency is 600Hz. This is just an indicative value. Some patients may prefer slower or faster stimulation.

Fittings made to the stimulation frequency must take into account a set of other interrelated parameters (intensity, Max. thresholds, number of active electrodes per frame).

The combination of this set of parameters may, in some cases, lead the system to automatically readjust the stimulation frequency value. A notification will indicate this change, and the button for accessing the "Strategies" parameter will stay red until this window is opened, as seen in the example below.



In the given example, the major change (number of active electrodes per frame from 6 to 16) to the "Stimulation" parameter causes the stimulation frequency to be automatically readjusted. In this extreme example, the slight decrease in the stimulation rate will have little or no effect on the patient's perception.

As noted above, automatically readjusting the stimulation rate depends on the following parameters: intensity, Max. thresholds and number of active electrodes. For reference, a fairly high setting (Max. thresholds at 60dB) would entail 14 active electrodes at 600Hz, 10 at 700Hz, or 8 at 800Hz.

## 2) Supplementary Window

### 2.1) Gains

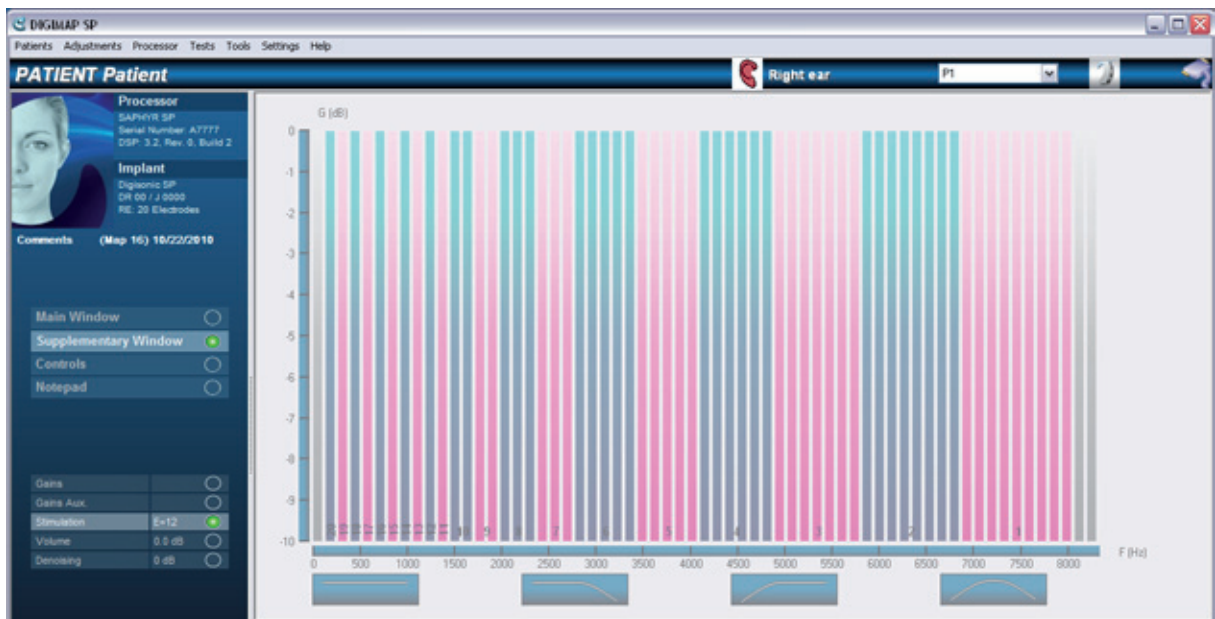
The “Gains” parameter enables you to balance the levels of all of the electrodes. It is possible to attenuate a specific electrode or frequency band.

This setting does not change the electrical parameters or the frequency distribution. It only changes the amplification in order to optimize the patient’s hearing comfort.

The attenuation value applied to a frequency band is expressed in decibels (dB) and can be modified by intervals of 1 dB between 0 and -10dB.

The “Gains” window appears as a diagram. The horizontal axis represents the frequency spectrum (Hz) and the vertical axis indicates the attenuation level (dB).

All of the frequency bands obtained with FFT during signal processing are displayed as vertical bars. The shaded bars correspond to inactive frequencies in the frequency representation. A single electrode, whose number is displayed at the bottom of the window, may contain several frequency bands, which are displayed in the same color.



#### a) Procedure

The attenuation value of a frequency band can be changed by moving the brush with the mouse and clicking on the desired level, or by using the arrow keys:

- Change frequency bands: left and right arrows
- Change the attenuation value: up and down arrows

#### b) Suggestions for use

The default setting corresponds to 0dB of attenuation for the whole spectrum.

This parameter can be managed based on standard criteria used for conventional hearing aid therapy. The gains function is often changed to take into account the patient’s feedback.

New preset functions for adjusting the gains are now available in this Digimap SP software version. Here are a few usage examples:

- The patient complains of echoes or resonance:

- Attenuate the low frequencies by 3-4dB
- Click on the button “next”



- The patient complains of crackling or unpleasant sounds:

- Attenuate the high frequencies by 3-4dB
- Click on the button “next”



The attenuation applied is rarely less than -6dB, though it may, in some cases, be a way to detect a problematic electrode during the talk over test.

It is recommended to use the Digiscope sensor if the fitting changes do not improve the patient's hearing comfort enough. The Digiscope enables you to view any abnormal saturation of one or more electrodes, and to therefore change the corresponding attenuation level.

## 2.2) Volume

This parameter adjusts the overall level of loudness. It compresses the dynamic range of the active electrodes.

*Note:* Certain parameters other than the volume also enable you to adjust the loudness level (loudness equalization, analog gain).

Volume is expressed in decibels (dB) and can be modified by intervals of 0.5dB between -3dB and 3dB.



### a) Procedure

The default value, 0dB, is automatically given for all activations.

Any change to this parameter can be made by moving the cursor with the mouse or by using the right and left arrow keys.

### b) Suggestions for use

The volume is adjusted primarily during the talk over test with the patient's participation:

- Decrease the volume if the voice is too loud
- Increase the volume if the voice is too quiet

For young children, it is recommended to test the fitting level using musical instruments or loud noises.

The "Volume" parameter compresses the dynamic range of the electrodes. In order to avoid saturation of the compression for extreme fitting values (-3dB or 3dB), it is recommended to adjust the parameter between -2dB and 2dB. If the level of loudness is still too low (or too high), it is recommended to recheck the electrical parameters, which may be undervalued (or overvalued).

Lastly, also check the magnetization of the antenna (an antenna that is not held in place well may reduce loudness).

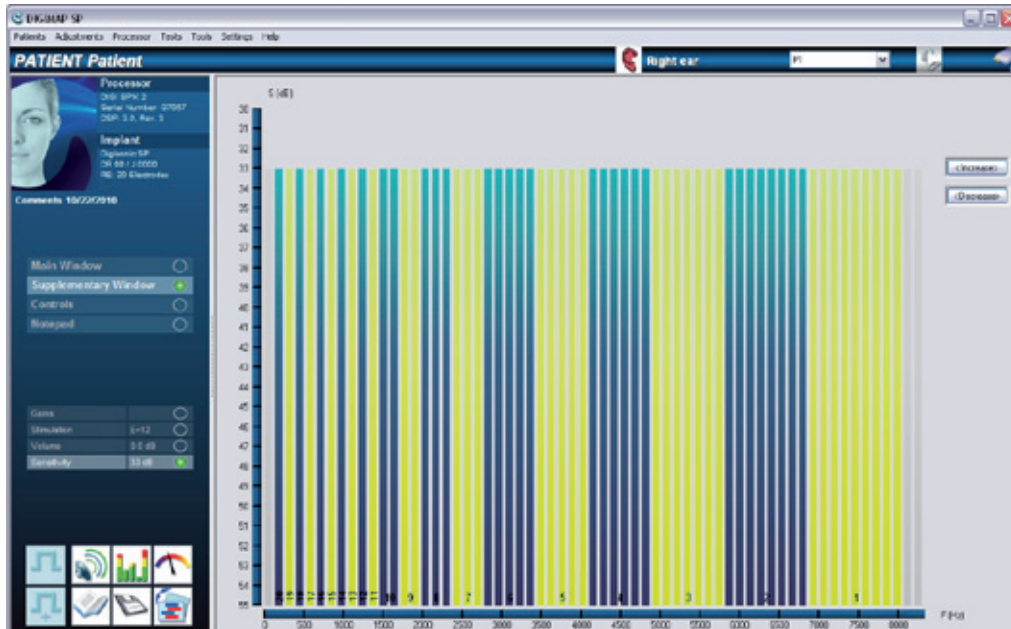
## 2.3) Denoising

The "Denoising" parameter changes the minimum noise level by preventing stimulation for acoustic signals below the set threshold. Only information from sound levels above the denoising threshold are processed.

Denoising is expressed in decibels (dB) and can be modified by intervals of 1dB between 0dB and -33dB for each frequency band in the system's spectrum.

In the "Denoising" window, the horizontal axis represents frequency (Hz) and the vertical axis indicates the denoising level (dB).

All of the frequency bands obtained with FFT during signal processing are displayed as vertical bars. The shaded bars correspond to inactive frequencies in the frequency representation. A single electrode, whose number is displayed at the bottom of the window, may contain several frequency bands, which are displayed in the same color.



#### a) Procedure

The default value is 0dB. For most situations this is best.

The denoising level can be globally changed for all of the electrodes using the "Increase" or "Decrease" buttons.

The value can also be changed for each frequency band by moving the brush with the mouse and clicking on the desired level, or by using the arrow keys.

#### b) Suggestions for use

It is recommended to keep the denoising level as close to 0dB as possible because this maximizes the information sent to the processor. The default of 0dB is the ideal and recommended value.

*Note:* The patient has a potentiometer on the processor which can be set to adjusting the denoising level (see the section entitled "Potentiometer", page 76). This control has a range of 10dB that extends between the set level (e.g. in the default case, 0dB) and -10dB relative to the set level.

- When the potentiometer is at position "3", the denoising value is the set level as defined in the denoising window (e.g. in the default case, 0dB).
- In position "0" (just before the off click), the denoising level will be -10 dB from the set level (-10dB in this example).

### 2.4) Stimulation

This window enables you to adjust the number of significant peaks extracted from the signal's spectrum in each stimulation frame (see the section entitled "Programming strategies", page 69).

The extraction uses an N of M strategy, as presented in the graph below:

- N is the number of electrodes stimulated during each pass through the electrode array.
- M is total number of electrodes enabled during the fitting.

The stimulation frequency is determined when choosing the programming strategy

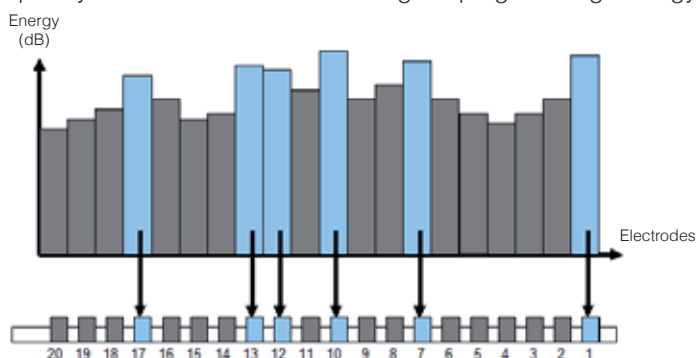
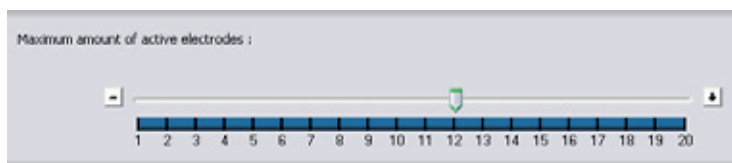


Figure showing the extraction of peaks (N of M)

The value of the "Stimulation" parameter is therefore expressed in the number of electrodes, and can be modified from 1 to M (total number of available enabled electrodes).



#### a) Procedure

The default value is 12 for monaural devices and 6 for binaural devices.

The number of electrodes stimulated per frame can be changed by moving the slider with the mouse or by using the left and right arrow keys.

#### b) Suggestions for use

The "Stimulation" parameter is set during the talk over test by having the patient provide feedback about the fittings when a varying number of electrodes are stimulated.

This parameter depends particularly on the patient's etiology, the length of time of their hearing loss, and when they received their implant. It must also take into account the stimulation mode (patients usually prefer a higher number when using constant current mode than constant voltage). The number of intracochlear and therefore enabled electrodes is a primary factor (In most cases N is between 8 and 12 when the total number of active electrodes (M) is 15 to 20).

Generally, the earlier implantation occurs, the higher N is. Conversely, the number of peaks may be limited if implantation occurred later on or if there is an associated disease.

For example, in cases of long-term hearing loss, adjust the number of peaks to the default value of 10, then reassess this number over the course of multiple fittings.

In cases of sudden or progressive hearing loss treated with early implantation, set the number of peaks at 12, then quickly reassess this number and increase it over the course of the next few fittings.

These values are provided for informational purposes and must of course be adapted to suit the fitting method used, each patient and each patient's etiology.

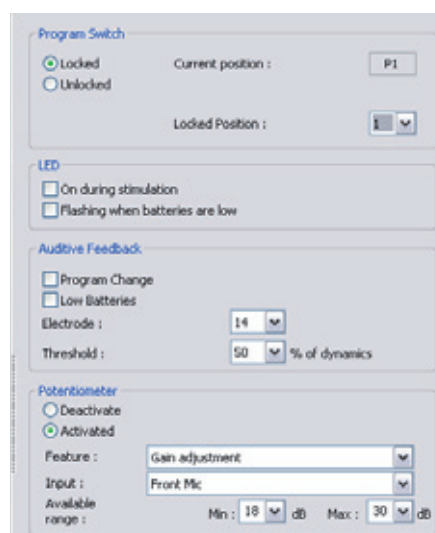
### In general:

- Increase the value to improve sound quality. The volume may be reviewed and decreased if necessary.
- Decrease the value if the patient has trouble hearing speech, detects resonance, or has trouble discriminating.

## 3) Controls

### 3.1) Button control

This window allows you to manage all of the controls that are available to the patient.



#### a) Program selector

This control is used to select the various programs configured by the audiologist. This switch has 4 positions for the 4 available program settings.

The selector can be locked upon request, particularly for young children. In such case, click on “Lock” then choose the program in the drop-down menu that will be used regardless of the selector’s position.

Only previously set programs are available as choices in the drop-down menu. It is not always necessary to activate all 4 programs. The audiologist can define the number of active programs (1 to 4) with the patient depending on his/her needs and listening conditions.

#### **A few reminders:**

- The “Current Position” displays the position of the processor’s selector at the present moment. This feature makes it possible to check that the selector is functioning properly. This feature for information only. It does not change the patient’s program when the processor is connected to the fitting software. The program being used during the fitting is always displayed in the information bar. Click on the drop-down list to switch from one program to another. During a talk over test, the patient receives information from the program that is selected in the information bar, not the program that corresponds to the physical position of the selector.
- The processor’s off position is now on the selector wheel instead of the selector like it is for the Digi SP.

#### b) LED

This indicator light can be configured according to the needs of the patient and his/her family and other support. Simply check the boxes if necessary as shown below:

- Indicate stimulation: when turning on, the indicator shines green for a few seconds, then flashes when the microphone is picking up sound. For this setting, check “On during stimulation”.
- Low battery detected: when turning on, the indicator shines green for a few seconds, then turns off. When the batteries are too low, the indicator slowly flashes red (once per second). For this setting, check “Flashing when the batteries are low”.

#### c) Auditory feedback

It is possible to choose an electrode and sound level (as a % of the dynamic range) to indicate when a program is changed and/or when the batteries are almost spent.

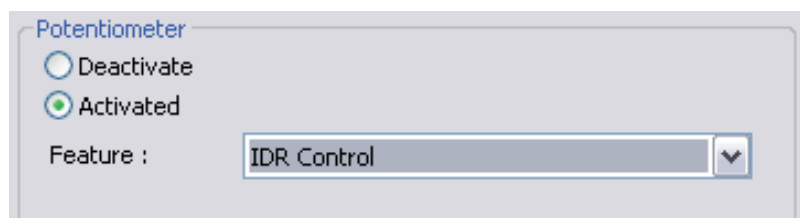
#### d) Potentiometer

Several functions can now be configured in the “Functionality” menu and can thus be adjusted by the patient using the potentiometer:

#### **Denoising fitting:**

This function is fairly similar to the method used to adjust the “Sensitivity” parameter on the previous generation of processors (Digi SP, Digisonic® BTE):

- When the processor’s selector wheel is in position “3”, the denoising level corresponds to the value defined in the “Denoising” window (default value of 0dB)
- When the processor’s selector wheel is near the “0” position (before the off position), the denoising level is 10dB less than the value defined in the “Denoising” window (more denoising) requiring more sound to begin stimulation.



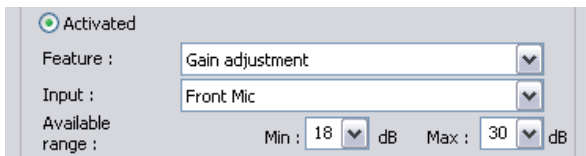
#### **Analog gain fitting:**

The Digimap SP software now makes it possible to adjust the amplification gain of the audio input. The default value of the analog amplification gain is 24dB. The gain, in this configuration, can therefore vary between 18dB and 30dB (which corresponds to 6dB of attenuation/amplification relative to the default value of 24dB).

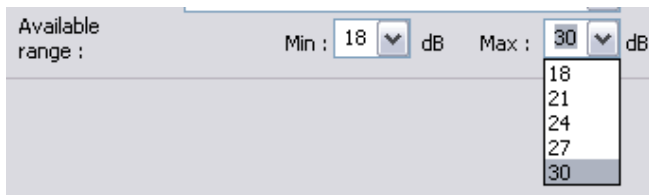
- When the patient puts the potentiometer in position “3”, the level of amplification gain corresponds to the Max. value (30dB in this example) of the available range defined in the “Controls” window. The sound heard by the patient is therefore louder than it was during the fitting session (talk over test with the value defined in the “Controls/Microphones” window).



- When the patient puts the potentiometer in position “0” (before turning off), the level of amplification gain corresponds to the Min. value (18dB in this example) of the available range defined in the “Controls” window. The sound heard by the patient is therefore quieter than it was during the fitting session (talk over test with the value defined in the “Controls/Microphones” window.)



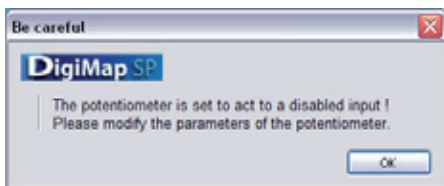
It is possible to adjust the range in which the analog gain is applied by changing the Min. and Max. values.



It is also possible to choose the input that the gain is applied to (front or rear microphone/Telecoil/Auxiliary input). This can be used if there is a special program for an accessory for which the microphone’s volume is not of importance.

*Note:*

- When setting a Zebra® processor, the analog gain function does not exist, but is instead replaced by the acoustic gain fitting.
- It is recommended to make sure that the input selected for the potentiometer is being used in the patient fitting. If not, the following message will be displayed.



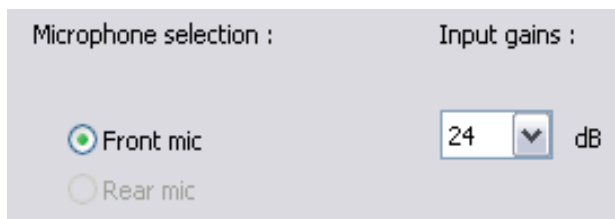
Depending on the audio input selected, the recommendations for adjusting the range of the analog amplification gain are the following:

- Rear microphone: from 18 to 30 dB
- Telecoil: from 0 to 15dB
- Auxiliary input: from 0 to 30dB (depending on the accessory used)

*Note:* If the potentiometer is locked (“Deactivated”) in the “Analog gain” function, the value defined is the value set in the “Controls/Microphones” window (default value of 24dB).

3.2) Microphones

The Saphyr® SP and Zebra® processors include two omnidirectional microphones. This parameter lets you select the microphone that is used to pick up the sound signal.

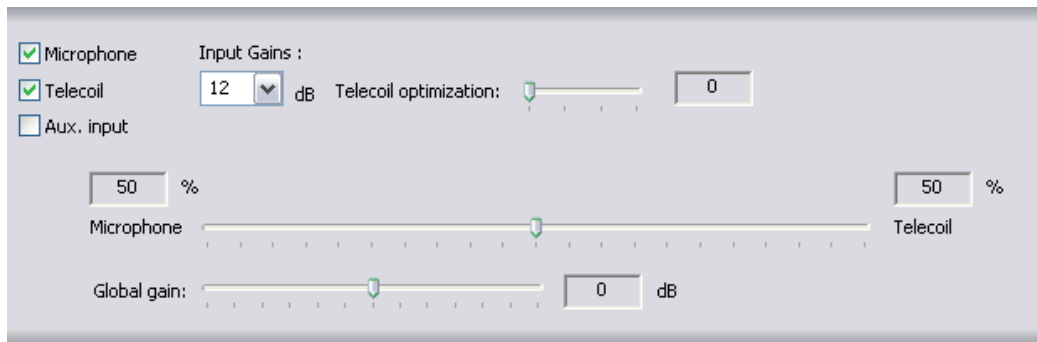


Furthermore, it is possible to define the value of the amplification gain for the input assigned to the selected microphone in this window.

- This test can be performed as a talk over test with the patient by first choosing the configuration “Mic. only”, then “Aux. only” in order to compare the difference between the two.
- It is also possible to perform the test using the Digiscope in order to check the saturation levels by first choosing the configuration “Mic. only”, then “Aux. only”.
- You may need to modify the “Gains”, the auxiliary input’s “Analog gain” or “Aux. gains” in order to balance the levels of the two inputs.
- Define the audio mix between the processor’s microphone and the auxiliary input. The default configuration is 50% - 50%, but it can be adapted differently according to the conditions of use (conference hall, classroom, etc.). For example, define a 20%-80% mix (Mic. - Aux) in one program and a 50% - 50% mix in another.
- Assess the level of perception and comprehension through a talk over test using the “Mic. + Aux.” configuration. If necessary, modify the audio mix in order to get the performance expected from the FM system and adjust the “Overall gain” and “Analog gains” parameters according to the patient’s level of comfort.

#### b) Telecoil

If using an amplifier with an induction loop, turn on the transmitter.



- Activate the Telecoil function in the “Control/Auxiliary Input” menu
- Define the audio mix between the processor’s microphone and the auxiliary input. The default configuration is 50% / 50%, but it can be adapted differently according to the conditions of use (movie theater, conference hall, personal system, etc.).
- Assess the level of perception and comprehension through a talk over test using the “Mic. + Aux.” configuration. If necessary, modify the audio mix and adjust the “Overall gain” and “Analog gains” parameters according to the patient’s level of comfort.
- If there is persistent background noise with the induction loop, it may be helpful to use the “Telecoil Denoising” function, which can be adjusted from 0 to 4.

We have tested various accessories that we recommend for using with the Telecoil. Ask the Neurelec Customer Service department for a list of these accessories.

### D. Other program

Once the current program (for example, P1) has been adjusted and accepted by the patient, it is then possible to define other programs that are totally independent from one another. For example:

- P1 quiet, P2 average, P3 comfortable, P4 loud.
- P1 old, P2 new, P3 accessory, P4 Telecoil
- P1 = P2 = P3 = P4

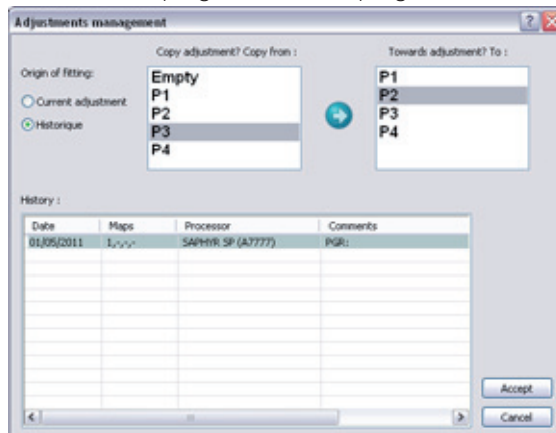
The different programs are generally similar and few parameters differ from one another. It is therefore easier to copy one program to another, then make the desired changes.

To do so, click on the “Fitting management” shortcut in the software. Choose the source program and the program that it will be copied to, then confirm. The Digimap SP software automatically switches to displaying the copied program, which can then be changed if necessary according to the patient’s needs.

The source fitting may come from:

- The current session
- A previous session: click on “History” to open the patient session history window. Then select the desired session from the displayed list and click “Select fitting”.

In the example above, program P3 is copied to program P2 from an earlier fitting session on 07/23/2010. This may be useful if the patient wishes to save the current fitting in a program as a precaution before moving on to a new fitting session.



All these indications can be adapted and adjusted for each patient in order to provide the greatest hearing comfort for each patient.

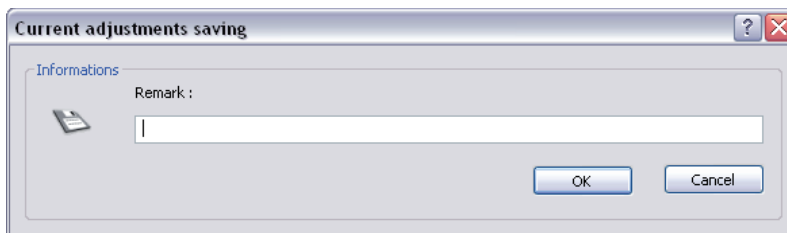
## E. End fitting session

Once fittings are complete and the programs have been validated with the patient in the talk over test, you can then proceed to close the fitting session. Go to the “Fittings/End of the fittings session” menu.

The procedure to end the fitting session consists of the different steps described below.

### 1) Save in the patient file

This step saves the final version of the fittings in the patient file that is stored locally on the computer. It corresponds to the “Fittings/Save fittings” option.



It is possible to decline saving, in which case the software automatically goes to the next save step.

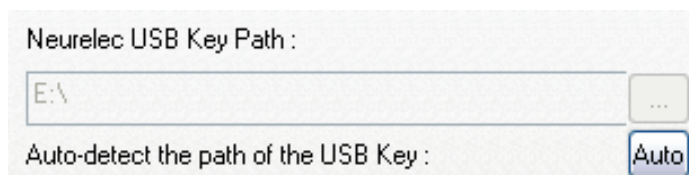
However, it is recommended to save the final version of the fittings in order to have an up-to-date patient file.

The comments added in the software column are automatically displayed in the save patient file window. It is, of course, possible to make changes before confirming.

### 2) Save to the storage media

This step is optional and is not the default unless a storage media (floppy disk or USB key) has been detected, configured, and validated in the “Settings/Preferences/Patient files” menu.

If the Neurelec USB key is connected, it is automatically detected, and the connection is indicated in the window. When using the Neurelec floppy disk, you must select the path for the storage media by clicking on the “...” button.



*Note:* The patient file can only be saved on the patient's own storage media. Furthermore, it is strongly recommended not to save the final fittings on a storage media that contains several patient files.

A backup copy of a patient's files can be made using the “Patients/Export a patient file” function.

### 3) Programming the processor

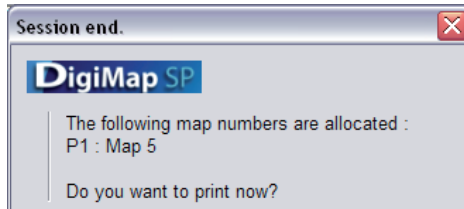
This final step saves (programs) the patient file in the processor.

Several choices are offered:

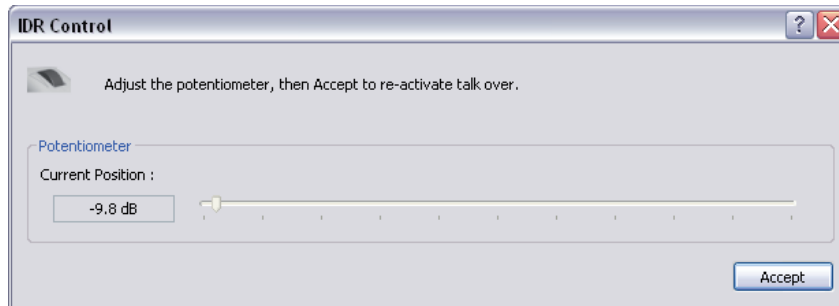
- Yes: the programming procedure is begun. It only takes a few seconds.
- No: the programming procedure is declined. The initial fittings (before the processor was connected) are restored.
- Cancel: the programming procedure is canceled and the software remains in communication with the processor in order to go back to the fittings window.

*Note:* The procedure to end the fitting session can be canceled by closing all of the displayed messages.

When the processor has finished being programmed, the software displays the updated Map numbering.



When the programming procedure is complete, the message below appears (unless the potentiometer has been locked in the fittings window). The cursor indicates the selector wheel's current position. This window reminds the user that the fittings have been configured to be used when the selector wheel is in position "3" (unless the potentiometer has been configured using "Analog gain").



After confirming this window, communication with the processor is terminated:

- Turn off the processor
- Disconnect the processor's interface cable
- Re-insert the batteries and turn on the processor while checking the position of the selector wheel.

### III. APPENDICES

#### B. Setting the DIGI SP'K (except Digi SP'K cx) processor

*Important:* Because the fitting procedure is very similar to the procedure for setting the Saphyr® SP processor, only the steps that are specific to the Digi SP'K processor are listed in this section. See the method for setting the [Saphyr® SP processor](#) for all steps not mentioned here.

##### 1) Connection

- Connect the interface to the computer's USB port and plug the interface cable's mini-DIN connector into the interface.
- The processor must be turned on and [the battery in its compartment](#)
- Connect the other end of the interface cable to the battery compartment socket.
- Open the software program, then choose "Processor/Connect".
- While communicating with the processor, the Digimap SP software reads the fittings contained in the processor. There are several possible connection scenarios, see the section in this manual entitled "Connection" (page 54)
- Place the processor on the patient's ear

*Note:* If an update is necessary, you will be prompted once you make the connection. Simply follow the instructions.

Once the processor is connected, the Digimap SP software opens program P1 by default.

##### 2) Fitting parameters

###### 2.1) Main Window

###### a) Impedances

See the method for the Saphyr® SP.

###### b) Thresholds

See the method for the Saphyr® SP.

###### 2.2) Supplementary window

The following parameters are adjusted using a talk over test in order to fine-tune the fittings based on the patient's feedback.

###### a) Stimulation

The default value for the number of significant peaks extracted from the signal's spectrum in each stimulation frame is 12, but the value can be adjusted from 1 to 20.

Generally, this parameter changes rapidly for children who receive an implant early on:

- For the first fitting: keep or, if necessary, increase the default value.
- For the following fitting sessions: increase the number of peaks based on the child's performance (speech therapy, parents' feedback, increased babbling, etc.).

See the method for the Saphyr® SP.

###### b) Volume

See the method for the Saphyr® SP.

###### c) Gains

See the method for the Saphyr® SP.

###### d) Denoising

The denoising level (and analog gain) cannot be adjusted for the Digi SP'K processor like they can for the Saphyr® SP processor. However, the Denoising parameter may be set in the software. To do this, see the method used for the Saphyr® SP processor.

## 2.3) Controls

The micro-processor has a push button for selecting programs and an indicator light.

### Push button:

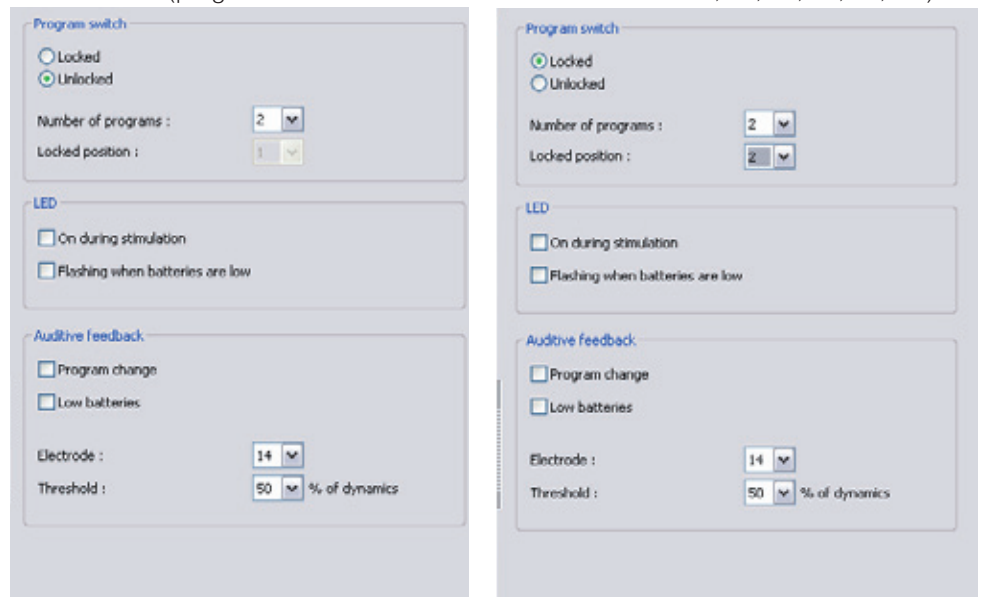
The Digi SP'K processor can store up to 4 independent programs (P1, P2, P3, P4). When the device is turned on, every time the push button is pressed, the next program is accessed (programs follow one after the other in the order P1, P2, P3, P4, P1, etc). If not all of the programs are activated during the fitting session, the processor will only allow active programs to be selected.

If the push button is locked, the "Locked position" must be selected in the drop-down menu. This program will then be used every time, regardless of whether or not the push button has been pressed down.

### Indicator light:

The four-color indicator (purple/blue/green/red) can be programmed and makes it easy to identify the status of the processor:

- Purple – Turning on: the indicator



shines purple briefly (2 seconds) to indicate that the processor is powering on

- Blue – Choosing a program and turning off: each time the push button is briefly pressed, the blue indicator flashes one or several times to indicate the selected program (1 flash: P1 selected, 2 flashes: P2 selected, etc.). Holding down the push button causes the blue light to stay lit, indicating that the device is in standby mode.
- Green – Indicates stimulation: the indicator flashes green when the microphone is picking up sound. This setting can be deactivated during the fitting session.
- Red – Low battery or other errors:
  - Low battery detected: the red indicator light flashes 3 times in a row, followed by steady, constant, rapid red flashing if the sound and light alert functions are activated. If the sound alert function is inactive, the red flashing will be constant. The setting for detecting low battery charge can be activated or deactivated in the "Button control" window.
  - Defective connection lead detected: the lights flash steadily, alternating between red and green.
  - Any other error detected: If there are 4 consecutive red flashes followed by 4 consecutive green flashes, it is recommended to turn off the device, then turn it on again. If the problem persists, contact your local distributor or Neurelec.

### 3) Other program

See the method for the Saphyr® SP.

### 4) End fitting session

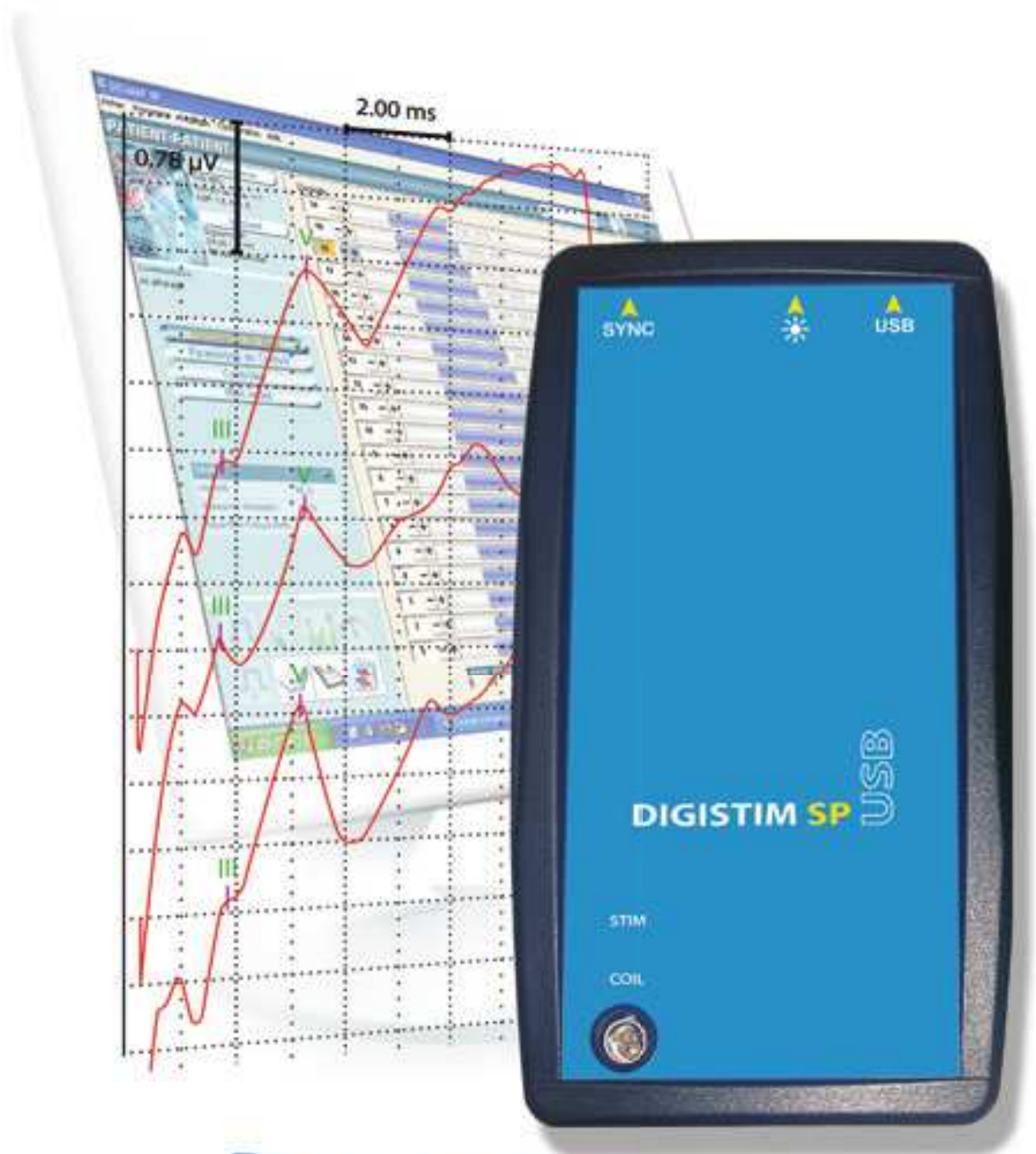
Once fittings are complete and the programs have been validated in the talk over test, you can then proceed to close the fitting session. Go to the "Fittings/End fitting session" menu.

The procedure to end the fitting session consists of the following steps:

- Save the current fitting session in the patient file: YES
- Save to a removable storage media: OK or cancel
- Program the current fittings in the processor: YES (otherwise the initial, pre-connection fittings will be restored).

When the processor has finished being programmed, the software displays the updated Map numbering.

Since the Digi SP'K processor does not have a selector wheel, the display window for this potentiometer does not appear. Disconnect the processor, check that the selected program corresponds to the program to be used, then put the device back on the patient's ear.



# Digistim® SP

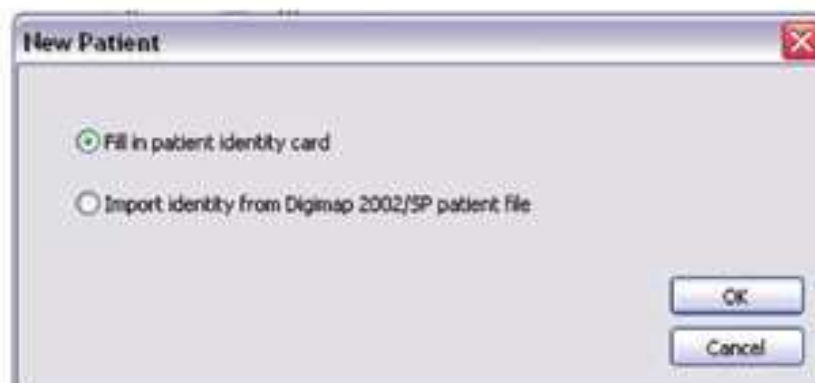
*Manuel Utilisateur*  
*User Manual*



neurelec  
SEE • FEEL • HEAR • LIVE

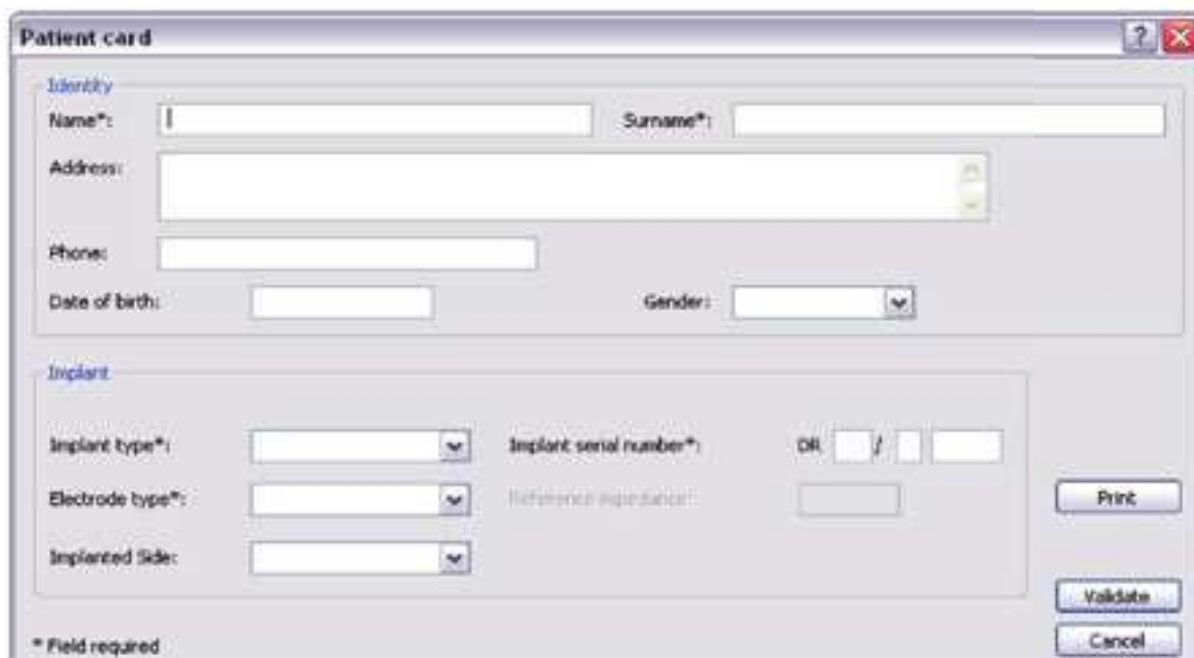
a. Creating a new patient file

The software suggests creating a new patient ID form as soon as the connection is made, if the patient file does not already exist in the local **DIGISTIM® SP** database.



Case of a new patient

Simply click on "*Fill in patient identity card*" to call up a new Patient card ready to be filled out (equivalent to the "*File/New patient*" option). All fields marked with an asterisk are compulsory and must be completed.

A screenshot of a "Patient card" form. The form is divided into two main sections: "Identity" and "Implant".  
The "Identity" section contains:  
- Name\*: text input field  
- Surname\*: text input field  
- Address: text input field with a scroll bar  
- Phone: text input field  
- Date of birth: text input field  
- Gender: dropdown menu  
The "Implant" section contains:  
- Implant type\*: dropdown menu  
- Electrode type\*: dropdown menu  
- Implanted Side: dropdown menu  
- Implant serial number\*: text input field with "OR" and a date separator "/"  
- Reference registration: text input field  
On the right side of the form, there are three buttons: "Print", "Validate", and "Cancel".  
At the bottom left, there is a note: "\* Field required".

Patient card



**Important:** Pay particular attention when entering the type of implant the patient has. Entering the wrong type could lead to inappropriate, and even painful, stimuli when the test is launched.

Once the card has been validated, a corresponding patient file is automatically generated and saved locally in a computer directory. The readings can start.

**Comment:** If the patient file does not exist in the computer, it is possible to import a Patient card from a Digimap patient file. Click on "*Import a Digimap 2002/SP file*" in the dialogue box that opens on connection.

b. Consulting an existing patient file

If the patient file already exists, simply load it from the local directory on the computer containing all patient files.

To do so, go to "*File/Local patient files access*".



List of local patient files

Simply highlight the relevant patient file on the list of patient files and click on "*Select*". The file is then loaded into the software and displayed as the current patient file.

**Comment:** It is also possible to load a patient file from a floppy disk (or any other removable storage device) by going to "*File/Read patient disk*".

## Tests

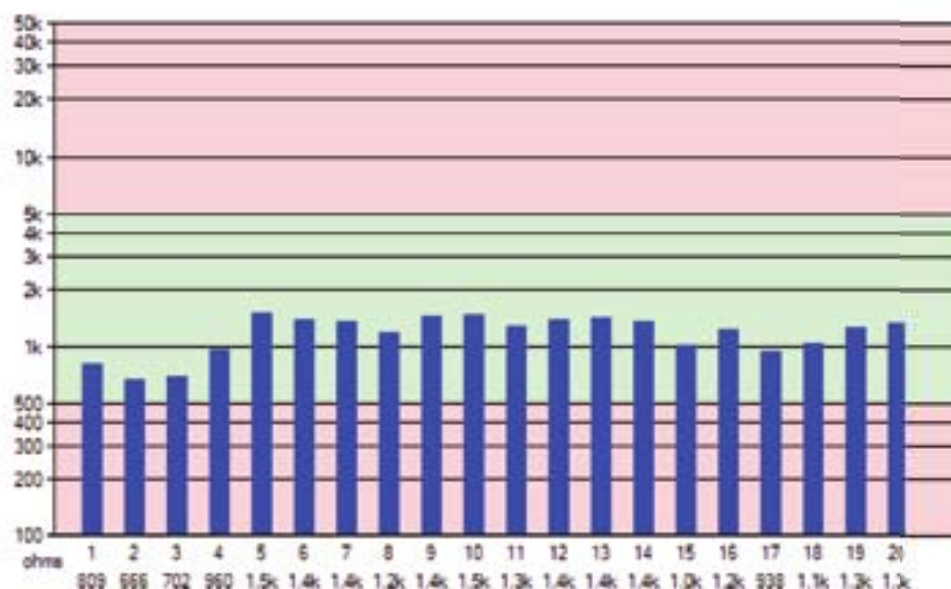
The **DIGISTIM<sup>®</sup> SP USB** system is used to carry out a certain number of tests to check, on the one hand, that auditory implants in the Digisonic<sup>®</sup> SP and Digisonic<sup>®</sup> ranges are working properly and, on the other hand, to measure implanted patients' auditory responses.

Most tests require an external data gathering device to be synchronised with the **DIGISTIM<sup>®</sup> SP USB**.

These tests, described in the following paragraphs, are included in the **DIGISTIM<sup>®</sup> SP** software.

### Impedance readings

An impedance reading checks that the electrodes are working correctly and the quality of the contact between the electrodes and the cochlea. This reading is only possible for Digisonic<sup>®</sup> SP implants.



Example of an impedance reading for a patient implanted with a basic Digisonic<sup>®</sup> SP with 20 electrodes

To carry out the reading:

- Place the antenna on the patient, opposite the implant
- Only use the cable supplied with the **DIGISTIM® SP USB** system
- Click on "*Measure*" or press the space bar on the computer keyboard
- The antenna must not move whilst the reading is being taken.

The reading commences after an adjustment phase that usually lasts for 2 or 3 seconds. The refresh rate is approximately once a second (automatic refresh detects any problems of intermittent contact).

To stop the reading, simply click on "*Stop stimulation*", or press the bar space, or switch to a different heading.

You can save the current reading by clicking on "*Save*". This also stops the reading.

Standard impedance values:

<b>Per-operative</b>	<b>Post-operative</b>
200 $\Omega$ to 2 k $\Omega$	1 k $\Omega$ to 5 k $\Omega$

**NB:** The system is designed for a distance of 2 mm to 12 mm between the antenna and the implant (thickness of skin).

### **Interpreting impedance readings**

- Value below standard value: Possibility of liquid seepage, short-circuit in electrode circuit.
- Value above standard value: Possibility of Electrode partially damaged or outside cochlea.
- High or infinite (Inf) impedance level: Electrode damaged, electrode circuit broken.

### **Action to take if the DIGISTIM® SP software indicates an error**

- "Coil Cable not connected or faulty" message: Check that the antenna-cable is connected to the **DIGISTIM® SP USB** unit properly. If it is, it may be damaged.

- "Implant not detected" message: Check that the distance separating the antenna from the implant is not too great ( $> 12$  mm). Alternatively, the patient's implant may be faulty.
- Other message: Check the distance separating the antenna from the implant. To take a reliable reading in cases of very thin skin (young children, etc), it may be necessary to insert a compress between the antenna and the skin.

### Integrity test

This test is designed to check that the implant is working properly. It is carried out using an external data gathering device.

### Integrity test

Parameters that can be modified:

- The range of electrodes to be tested (for example, from 1 to 10, or from 8 to 5) and the direction in which they are scanned
- Type of test (High-speed or Complete)
- Stimulation frequency (from 1 Hz to 100 Hz)
- Stimulation amplitude (from 30 to 130)
- Pulse width (from 2  $\mu$ s to 250  $\mu$ s)
- Stimulation number to average (from 1 to 1000)

## Stapedius reflex

This test determines an electrode's maximum threshold in an objective manner, by measuring the activity of the stapedius muscle. One or more electrodes are stimulated simultaneously – either continuously or intermittently. A synchronisation pulse is sent before each stimulation burst.

Electrode	S. Min [Fstim]	S. Max [Fs...	Impulsion (...)
<input checked="" type="checkbox"/> 1			5
<input type="checkbox"/> 2			5
<input type="checkbox"/> 3			5
<input type="checkbox"/> 4			5
<input type="checkbox"/> 5			5
<input type="checkbox"/> 6			5
<input type="checkbox"/> 7			5
<input type="checkbox"/> 8			5
<input type="checkbox"/> 9			5
<input type="checkbox"/> 10			5

## Stapedius reflex test

Parameters that can be modified:

- Electrode(s) to be tested (ticked on a list)
- Stimulation Type (Continuous or Intermittent)
- Frequency of stimulation (from 1 Hz to 2000 Hz)
- Amplitude of stimulation (from 30 to 130)
- Pulse width for each electrode (from 2  $\mu$ s to 250  $\mu$ s)
- Stimulation mode in the case of Digisonic<sup>®</sup> SP implants (U: voltage, or I: electric current)

- Transmission power.

Three further parameters can be defined for the intermittent stimulation mode:

- Bursts Number
- Duration of each burst
- Delay between bursts.

## PROBLEM SOLVING

### 1) Problems and solutions

This device is highly dependent upon the proper working order of the computer to which it is linked. It is highly likely that any breakdown you may encounter is quite simply due to a problem linked to recognition of the drivers or a problem linked to the USB port.

Therefore, in the event of a problem with the **DIGISTIM® SP USB** system, kindly refer to the following problem-solving guide. If the guide fails to provide a solution to your problem, then contact Neurelec's after-sales department; it alone is qualified to maintain its products.

Problem	Possible cause	Solution
The READY light does not come on	Problem with USB connection	Ensure that the USB cable is linked to a USB port on the computer and not to a self-powered HUB, and that the interface itself is properly connected. There may be too many peripherals connected to your computer's USB ports. In this case, unplug some of them, including the <b>DIGISTIM® SP USB</b> , and then try to reconnect it.
	Problem installing the drivers	Repeat the procedures described in page 57 of this User Manual. If the problem is not resolved, it may reside in the computer. If this is a possibility, please try using a different computer before contacting Neurelec's after-sales department.

Problem	Possible cause	Solution
The READY light is on, but the <b>DIGISTIM® SP</b> software refuses to connect to the <b>DIGISTIM® SP USB</b> unit	Wrong version of the software	Please unplug the <b>DIGISTIM® SP USB</b> unit, reinstall the correct version of the software
The STIM light does not glow green when the <b>DIGISTIM® SP</b> software is launched	Problem installing the drivers	If the software refuses to connect with the <b>DIGISTIM® SP USB</b> unit, reinstall the software and try again.
The STIM light does not flash red when a stimulus is launched	Equipment defect	If the problem persists, contact Neurelec's after-sales department.
The STIM light constantly glows red	Defect detected during self-diagnosis of the <b>DIGISTIM® SP USB</b> unit	Unplug the <b>DIGISTIM® SP USB</b> unit, wait a few seconds, then plug it back in. If the problem persists, contact Neurelec's after-sales department.
The "Stimulation" button is not available	No patient file selected in the software	Load a patient file, or create one, to be able to launch stimulation (page 71).