

SENTIVA[®]

Technical Guide



LivaNova
Epilepsy

VNS Therapy[®]

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INDICATIONS FOR USE

The VNS Therapy Programming System supports the delivery of personalized Vagus Nerve Stimulation (VNS) Therapy for drug-resistant epilepsy (DRE).

This guide contains information on the use of the VNS Therapy® Programming System with the Model 3000 Programmer and Model 2000 Programming Wand. Please refer to the VNS Therapy® Programming System Physician's Manual for additional important prescribing and safety information.

Indication for Use

The VNS Therapy System is indicated for use as an adjunctive therapy in reducing the frequency of seizures in patients 4 years of age and older with partial onset seizures that are refractory to antiepileptic medications.

This overview is not intended to be a substitute for the VNS Therapy Physician's Manual.

Please note that not all products shown in this Technical Guide are cleared for sale in all markets. Please check with your local representative to see what is available in your area.

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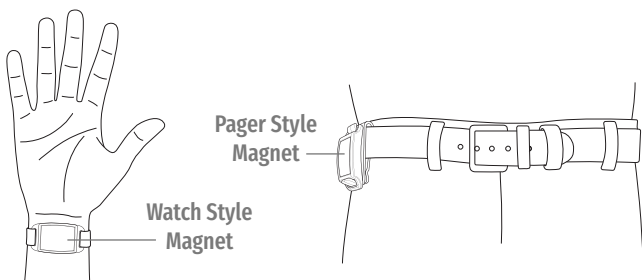
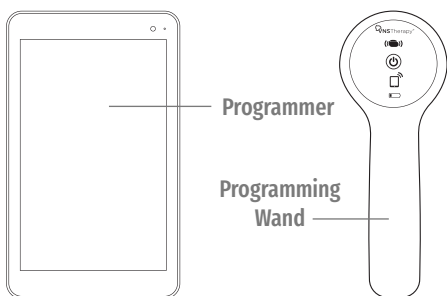
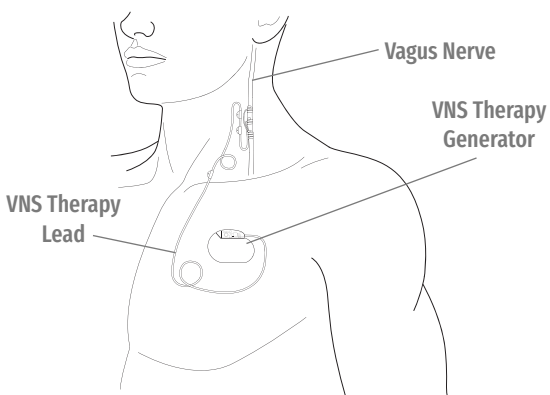
Product Overview

INTRODUCTION TO VNS THERAPY

The VNS Therapy® System supports the delivery of personalized Vagus Nerve Stimulation (VNS) Therapy for drug-resistant epilepsy (DRE).

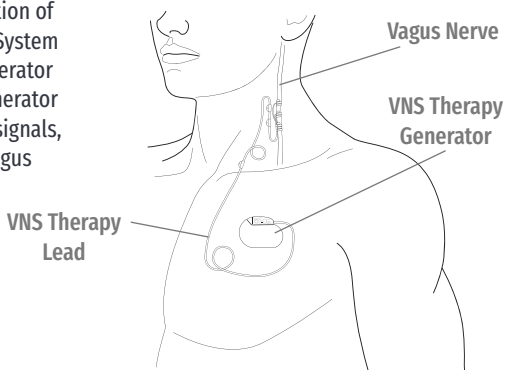
The VNS Therapy® System includes four parts:

- Generator and lead
- Programmer (tablet and software)
- Wand
- Magnet



Generator and Lead

The implanted portion of the VNS Therapy® System consists of the generator and a lead. The generator delivers electrical signals, or pulses, to the vagus nerve via the lead.

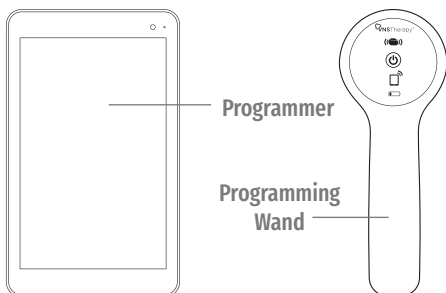


Programmer (M3000)

The external portion of the VNS Therapy® System consists of a programmer (a computer tablet with VNS Therapy® programmer software pre-installed) and a wand (M2000). The programmer and the wand connect wirelessly. This training module is developed for the M3000 programmer and M2000 wand. The programmer and wand are required for use.

The programmer and wand work together to:

- Interrogate (communicate with the generator) in order to adjust therapy parameters for the generator
- Assess whether the generator and lead are functioning as expected
- View device histories
- Export session reports

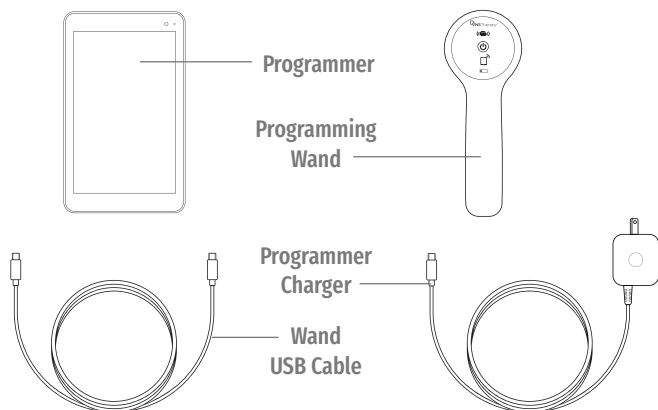


Wand (M2000)

The wand is designed to communicate wirelessly with the programmer (M3000) at distances up to 3 meters (10 feet) under most conditions. If communication is unstable, use the supplied USB cable to connect the wand and the programmer instead.

Hold the wand no more than 1 inch away from the generator in order to maintain good communication.

The wand operates on two AA lithium or alkaline batteries.



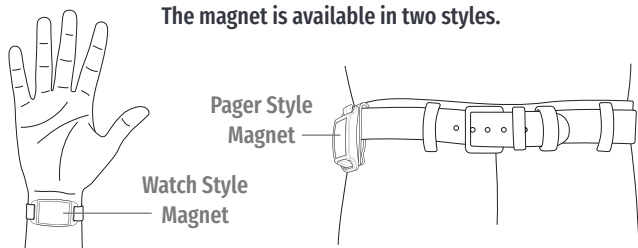
Magnet

The VNS Therapy® System has a patient controlled feature that can be activated with a specially designed magnet.

The magnet can be used to:

- Attempt to reduce the intensity of or abort an oncoming seizure or seizure in progress
- Temporarily inhibit stimulation
- Verify the generator is providing stimulation
- Reset the generator (in combination with the programmer and wand)

The magnet is available in two styles.



Product Compatibility

There are different VNS Therapy® generator models, including the new SenTiva® generator.

The VNS Therapy® Programmer, Model 3000, and Wand, Model 2000, allow you to interrogate and program the following VNS Therapy® generators:

- Model 102 Pulse™
- Model 102R Pulse Duo™
- Model 103 Demipulse®
- Model 104 Demipulse Duo®
- Model 105 AspireHC®
- Model 106 AspireSR®
- Model 1000 SenTiva®

Please see the following chart to determine the generator's compatibility with other VNS Therapy® components.

The table below details the compatibility for all components of the VNS Therapy® system

	Lead				Tuneler 402	Programming Wand (Programmer)		Accessory Pack 502	Patient Essentials Kit 220
	300*	302†	303†	304†		201 (M250)	2000 (M3000)		
102[†] Pulse™		✓	✓	✓	✓	✓	✓	✓	✓
102R[†] Pulse Duo™	✓				✓	✓	✓	✓	✓
103[†] Demipulse®		✓	✓	✓	✓	✓	✓	✓	✓
104[†] Demipulse Duo®	✓				✓	✓	✓	✓	✓
105[†] AspireHC®		✓	✓	✓	✓	✓	✓	✓	✓
106[†] AspireSR®		✓	✓	✓	✓	✓	✓	✓	✓
1000[†] SenTiva®		✓	✓	✓	✓		✓	✓	✓

* No longer distributed

† Not for sale in all markets

VNS Therapy® Modes

The VNS Therapy® System can function in three different modes:

NORMAL MODE

In Normal Mode, the generator initiates intervals of stimulation at preset ON and OFF times throughout the day. Specific stimulation parameters are set by the healthcare provider.

MAGNET MODE

Magnet Mode is an on-demand stimulation that attempts to abort or de-intensify an oncoming seizure or a seizure in progress. The patient or caregiver initiates Magnet Mode by passing a VNS magnet over the implanted generator.

AUTOSTIM MODE

Automatic stimulation, or AutoStim, is an optional feature in some generator models. AutoStim delivers stimulation when the generator detects a rapid relative heart rate increase ($\geq 20\%$) that may be associated with a seizure. This feature works in conjunction with Normal Mode and can be inhibited using the VNS magnet.

SenTiva System Management

GETTING STARTED

To get started, collect all the components of the VNS Therapy® System:

- Touch-screen programmer preloaded with VNS Therapy® programmer software
 - Wireless wand (Model 2000) with two AA lithium or alkaline batteries
 - Programmer charger
 - Type A-C USB cable (used to connect to charger to charge the programmer)
 - Type C USB cable (option to connect programmer to wand)
 - Type A-C USB drive (used to import/export protocols and export session reports)
-

Before Using the Programming System in a Patient Session

- Charge the programmer
 - Turn the programmer ON
 - Check the programmer battery: Check the battery status on the BATTERY INDICATOR at the top right corner of the programmer screen
 - Check the wand batteries: Confirm that the wand batteries are not low
 - Change the date and time if necessary. Accurate patient and device history stored in the programmer depend on correct date and time settings
 - Connect the wand to the programmer
 - Interrogate the generator (check communication between the programmer and the generator)
-

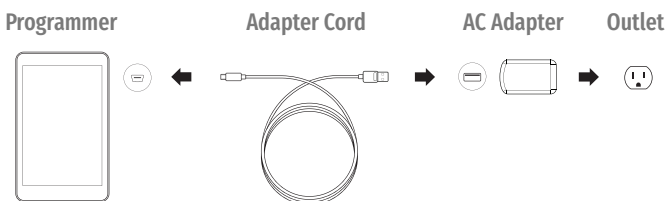
Charge the Programmer

Charge the programmer before use so that there is adequate battery power during a patient session.

To charge the programmer:

- Connect the adapter cord to the programmer and to the AC adapter
- Plug the AC adapter into an outlet

A fully discharged battery may take four to five hours to charge.



Turn the Programmer ON/OFF

Charge the programmer before use so that there is adequate battery power during a patient session.

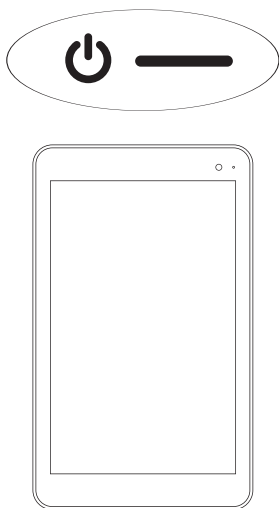
To turn programmer ON:

Press and hold the **POWER** button for 3 seconds and then release. You will then see an on-screen logo, and the VNS software will start.

To turn programmer OFF:

Press and hold the **POWER** button for 3 seconds and then release. Follow the on-screen instructions to shut down the programmer.

- After 10 minutes of inactivity, the screen will automatically turn off
- To manually turn the screen off: Quickly press and release the **POWER** button. Use this method when you want to preserve battery, but not shut down the Programmer



NOTE:

The **POWER** button may not respond if the programmer is still shutting down. Wait for 30 seconds after a shutdown to restart the programmer.

Navigation

There are two main screens on the programmer.
Each of these screens acts as a launching point for other functions.

Main Screen – the first screen you see after turning on the programmer, when the programmer is still OUT OF SESSION (programmer is not yet communicating with a generator)

Summary Screen – the first screen you see once you are IN SESSION (programmer is communicating with a generator)

OUT OF SESSION VS. IN SESSION

Available functions change based on whether the programmer is out of session or in session.

- OUT OF SESSION (programmer is not communicating with a generator)
- IN SESSION (programmer is communicating with a generator)

Quick Access Bar – From any software screen, tap the VNS Therapy® logo on the title bar (black bar at the top of the screen) to access programmer settings and system information.

This drop-down menu shows the following:

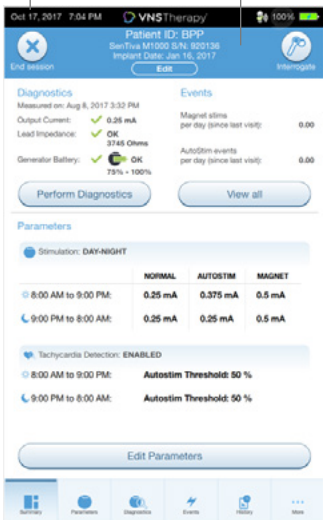
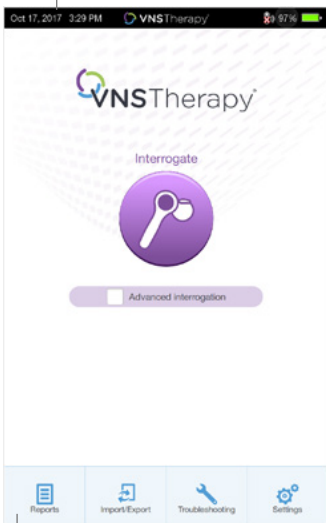
- Programmer date and time (OUT OF SESSION only)
- Wand connection status
- Programmer battery level
- Sliders to adjust the system volume and display brightness
- Programmer software version
- Wand software version and generator firmware (IN SESSION only)

Navigation Bar – From any software screen, tap the icons at the bottom of the screen to access additional features

Patient ID Bar – If the blue patient ID Bar is showing on the screen, the programmer is IN SESSION. To end the session, tap on the **END SESSION** button at the left of the Patient ID Bar

Quick Access Bar

Patient ID Bar



Main Screen (Out of Session)

Summary Screen (In Session)

Navigation Bar

Check the Programmer Battery

Before using the programmer with a patient, confirm that the battery is fully charged.

To check the battery:

Look at the BATTERY INDICATOR in the top right corner of every screen



Check the Wand Batteries

- 1. To turn wand ON:** Press and release the **POWER** button
 - If the battery is OK, green arcs around the power button will light up to indicate that the wand has power
 - **Two green arcs** indicate that the wand is available for connection with the programmer
 - **Four green arcs** indicate that the wand is connected to the programmer
 - If the battery is low, the Low Battery Indicator will light up. If this happens, replace the batteries before using the device
 - If only the Low Battery Indicator lights up (no green arcs), no communication will be possible until you replace the batteries
- 2. To replace batteries:** If batteries are low, remove the battery compartment cover on the back of the wand and replace the batteries with two new AA lithium ion or alkaline batteries



Turn Wand Power On



Battery OK Indicator



Low Battery Indicator



Low Battery Power/
No Communication

Wand Battery Replacement

Push and slide to open battery compartment



NOTE:

When illuminated, the flashing white icon at the top of the screen indicates that there is communication with the generator.

Change Date and Time

Accurate patient and device history stored in the programmer depends on correct date and time settings. Before using the programmer with a patient, verify that the time and date on the programmer are correct. This will ensure that the session is properly time-stamped.

1. Navigate to the Date & Time screen:

- OPTION 1: From the Main Screen, tap the VNS Therapy® logo on the title bar (black bar at the top of the screen)
- OPTION 2: From the Main Screen, select **SETTINGS** from the bottom navigation bar
- On the Settings Screen, tap the **EDIT** button at the top of the page near the time

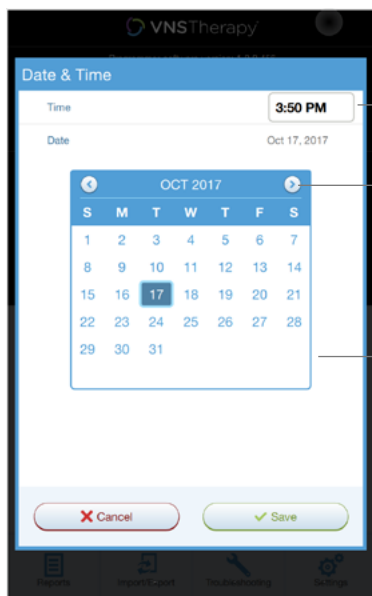
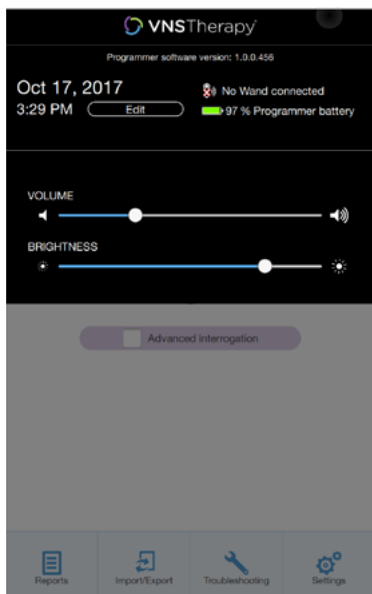
2. To change time: Tap the current display time and scroll up or down

3. To change date: Use **LEFT** or **RIGHT ARROW** to adjust the calendar, and then tap the desired date



Main Screen

Navigation Bar



Tap and scroll to change time

Use left and right arrows to change month

Tap the desired date

NOTE:

You must adjust the programmer manually for time zones or Daylight Savings Time.

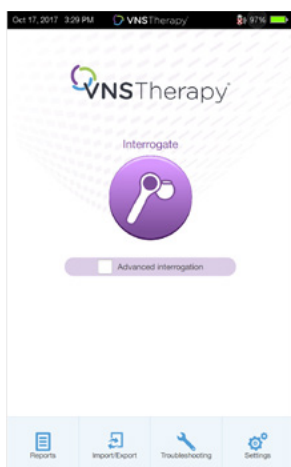
Connect the Wand to the Programmer

The programmer and the wand can be connected wirelessly or with a backup USB cable.

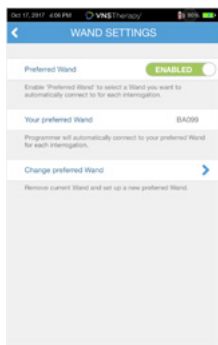
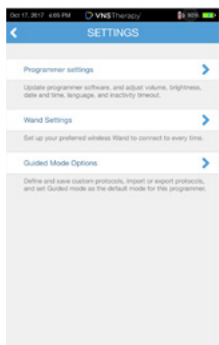
WIRELESS CONNECTION

To set up wireless connection:

1. Turn on the programmer
2. Turn on the wand. Look for two green lights on the wand, indicating that power is on and the wand is ready to connect
3. From the Main Screen on the programmer, tap on **SETTINGS** in the Navigation Bar at the bottom of the screen
4. From the Settings Screen on the programmer, tap on **WAND SETTINGS** > **PREFERRED WAND**
5. Tap on the preferred wand serial number (found on the back of the wand) to enable the preferred wand or to change wands
6. Tap on **BACK** (upper left) to return to the Main Screen
7. Look for two green arcs on the wand to indicate the wand is available for connection with the programmer. Once availability is established, four green arcs on the wand to indicate that the programmer and the wand are connected. The green lights will stay on for 10 minutes when the programmer and wand are connected. When they are not connected, the green lights will go off after 2 minutes



Main Screen



NOTE: Wireless

“Preferred” connection - recommended for wands and programmers that are always used together. Provides a quicker connection when interrogating a patient’s generator because the programmer automatically looks for the preferred wand. “Choose a wand” connection recommended if there are several interchangeable programming systems in your area. When interrogating a patient’s generator, the programmer searches for all available wands in range.

SHORTCUT

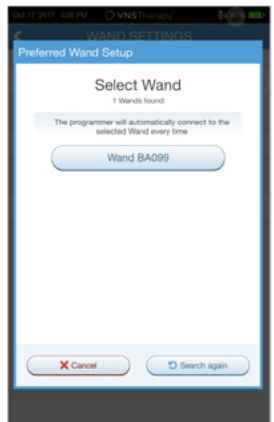
You can set up a wireless connection automatically by starting the interrogation. The programmer will prompt you to save the preferred wand information as part of the workflow.

WIRED CONNECTION

Use the supplied USB cable to connect the wand to the programmer.

To set up wired connection:

1. Connect the programmer to the wand using the USB cable
2. Tap **INTERROGATE** on the programmer. The programmer will automatically connect to the preferred wand and display the wand’s information on the screen, indicating that the programmer and the wand are connected
3. Look for four green lights on the wand to indicate that the programmer and the wand are connected. The green lights will stay on for 10 minutes when the programmer and wand are connected. When they are not connected, the green lights will go off after 2 minutes



Interrogate the Generator

You must interrogate the generator before performing other functions, such as changing parameters or performing diagnostic tests.

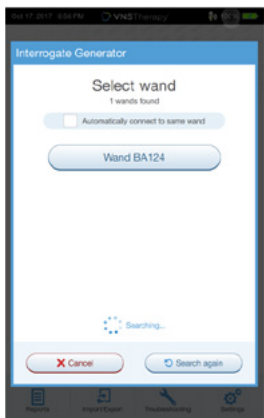
To interrogate the generator:

1. Turn on the programmer
2. Turn on the wand. Look for two green lights on the wand, indicating that power is on and the wand is ready to connect
3. On the Main Screen, tap **INTERROGATE**
4. **Preferred wand:** If you have set up a preferred wand, the programmer will automatically connect to the preferred wand and display the wand's information on the screen, indicating that the programmer and the wand are connected
5. **No preferred wand:** If you have not set up a preferred wand, the programmer will show all powered-on wands in range. Select the serial number for the wand you intend to use. The programmer will connect to that wand and display the wand's information on the screen, indicating that the programmer and wand are connected
6. Place the wand over the generator
7. If the interrogation is working, a generator icon will flash on the wand screen

NOTE:

When the **ADVANCED INTERROGATION** box on the Main Screen is checked, the programmer will download detailed data from the generator for the previous 180 days during interrogation. These data will be displayed in the Events and Trends tab which is accessible from the Navigation Bar.

For rapid interrogation, uncheck the **ADVANCED INTERROGATION** box.



NOTE:

Check box only appears if the programmer does not have a preferred wand. If a preferred wand is selected, the programmer will search and automatically connect to the preferred wand.



After a successful interrogation, the Summary Screen will display. From this screen, you can perform the following functions:

- View generator ID information, including model number and serial number
- View and edit patient data, such as patient ID and implant date
- View last known diagnostics data, such as lead impedance and battery status
- Change settings to generator parameters, such as Normal, Magnet, AutoStim, or Detection settings
- Perform Diagnostics
- View events and trends such as magnet activations and daily average AutoStims
- Access device history, including parameter settings associated with prior office visits
- Interrogate the generator again to verify parameters or refresh data
- End programming session
- Access other software options

- 1 Current Programmer date and time
- 2 Wand connection and Programmer battery status
- 3 Ends current session
- 4 Generator and patient information
- 5 Interrogate generator
- 6 Last known diagnostics measurements
- 7 View stimulation events
- 8 Current parameters
- 9 Navigation bar to additional software features
- 10 Shortcut buttons

The screenshot shows the VNS Therapy mobile application interface. At the top, a status bar displays the date and time (Oct 10, 2017 9:47 AM), the VNS Therapy logo, and battery status (100%). Below this, a blue header bar contains patient information: Patient ID: abc, AspireSR M106 S/N: 41702, and Implant Date: Dec 22, 2016. Callouts 1-5 point to the status bar, the 'End session' button, the patient information area, the 'Interrogate' button, and the 'Interrogate' icon respectively.

The main content area is divided into two sections. The 'Diagnostics' section (callout 6) shows measured values for Output Current (1.5 mA), Lead Impedance (4647 Ohms), and Generator Battery (75% - 100%). The 'Events' section (callout 7) shows Magnet stimulations and AutoStim events per day. Callouts 10 point to the 'Perform Diagnostics' and 'View all' buttons.

The 'Parameters' section (callout 8) contains a table comparing Normal, AutoStim, and Magnet settings for Output, Frequency, Pulse Width, On Time, Off Time, and Duty Cycle. Callout 10 points to the 'Edit Parameters' button at the bottom of this section.

At the bottom, a navigation bar (callout 9) includes icons for Summary, Parameters, Diagnostics, Events, History, and More.

	NORMAL	AUTOSTIM	MAGNET
Output:	1.5 mA	1.625 mA	1.75 mA
Frequency:	20 Hz		
Pulse Width:	250 μ Sec	250 μ Sec	500 μ Sec
On Time:	30 sec	60 sec	60 sec
Off Time:	5 min		
Duty Cycle:	10 %		

IN OFFICE PROGRAMMING

The SenTiva® (M1000) VNS Therapy System offers a number of new features that help simplify and customize patient care.

The generator's output current for the programmed stimulation in all modes must be 0 mA for the first 14 days after implantation.

➤ **Manual Programming**

Manually adjust parameters

➤ **Prone Position/Low Heart Rate Detection**

Monitor the patient for episodes of low heart rate and prone body position after an AutoStim or magnet activation

➤ **Guided Programming**

Simplifies programming with option of Standard or Custom Therapy Protocols

➤ **Scheduled Programming**

Automatically change parameter steps according to a preset schedule

➤ **Day/Night Programming**

Delivers two independent sets of therapy parameter schedules at different times during a 24-hour period

NOTE:

The programmer must be IN SESSION to access these features.

NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.

Manual Programming

Use Manual Programming to adjust stimulation and/or detection parameters individually.

To manually program parameters:

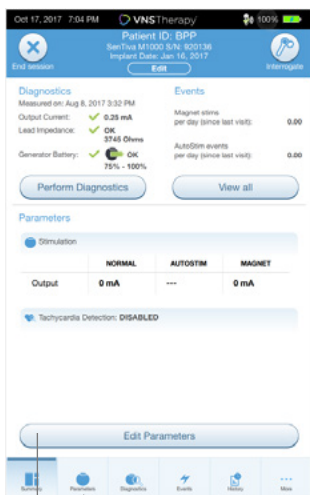
1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, or tap on **PARAMETERS** in the Navigation Bar at the bottom of the screen
2. On the Parameters screen, select the Stimulation or Detection Tab. Follow the on-screen prompts to make change to parameters
3. Tap **APPLY CHANGES** to program your changes

NOTE:

- After Implant: Set output current to 0 mA, slowly increase by 0.25 mA increments until patient feels stimulation at a comfortable level
- Replacement Generators: Set output current at 0 mA, slowly increase by 0.25 mA to previous therapy level to allow patient time to re-adjust

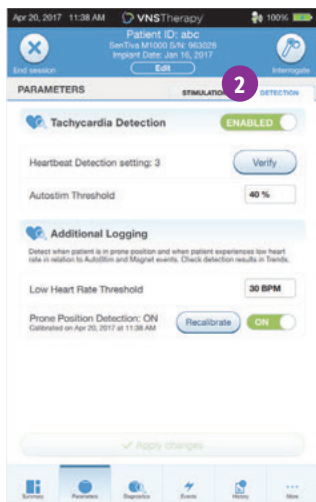
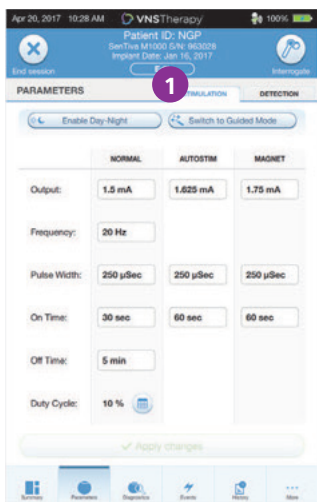
NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.



Edit
Parameters

Parameters



1 Stimulation Tab

2 Detection Tab

Tachycardia Detection

You may enable or disable Detection. If Detection is Disabled, then the model 1000 generators use only Normal and Magnet stimulation. If Detection is Enabled, then parameters for AutoStim will become available, in addition to Normal and Magnet parameters.

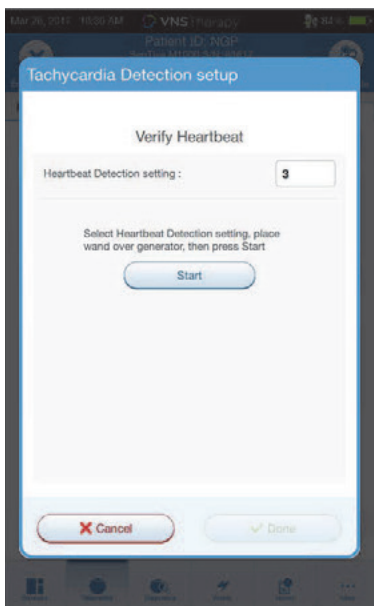
When you enable Detection for the first time, the software will prompt you to set the Heartbeat Detection setting and AutoStim Threshold. These settings work together to ensure the generator is accurately detecting the patient's heartbeats, and set the criterion for AutoStim delivery based on changes in heart rate, respectively. Once Detection is enabled, you can adjust the settings from the Detection tab as needed.

In order for the generator to accurately detect heartbeats, the heartbeat detection must be set for the individual patient. Manually select from a range of heartbeat detection sensitivity values: 1 (least sensitive; for use with largest amplitude ECG signals) to 5 (most sensitive; for use with smallest amplitude ECG signals). The setting will not change unless manually programmed to a different value.

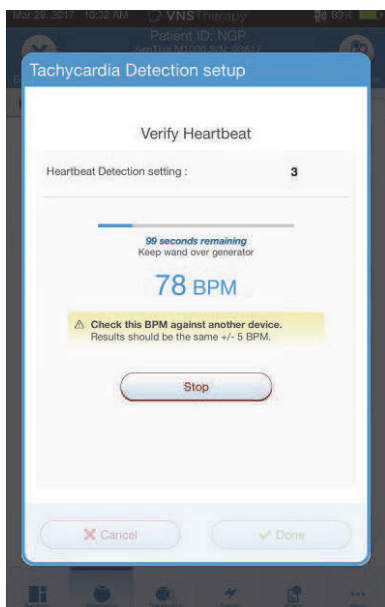
When Detection is enabled, the software will walk you through heartbeat detection setting verification and AutoStim Threshold selection.

To Verify Heartbeat Detection:

1. Select **VERIFY** on the Detection Tab to confirm the accuracy of the heart rate detected by the generator or to change the Heartbeat Detection setting
2. Place the Wand over the generator and press **START** to begin the test. Keep the Wand over the generator during the entire Verify Heartbeat Detection process. The generator will transmit a signal and the Programmer will display the detected heart rate in beats per minute (BPM) for up to two minutes



3. Wait for the heart rate display to stabilize (at least 10 seconds) and compare the generator-detected heart rate displayed on the Programmer with an independent source (such as BPM from another ECG monitor or a manual pulse count). Accurate detection should be within ± 5 BPM or 10%. If the heart rate reported by the Programmer is too high, then the Heartbeat Detection setting should be adjusted downward (toward setting 1). If the heart rate reported by the Programmer is too low or displays “?? BPM”, then the Heartbeat Detection setting should be adjusted upward (toward setting 5). Refer to “Troubleshooting” in the Physician’s Manual for more information
4. If the heartbeat detection is verified before the two minute test completes, keep the Wand over the generator and select **STOP** on the screen. Once you observe accurate heartbeat detection, you have completed the verification process. If you are enabling Detection, select **NEXT** to set the AutoStim Threshold. Otherwise, select **DONE** to return to the Parameter Screen



CAUTION:

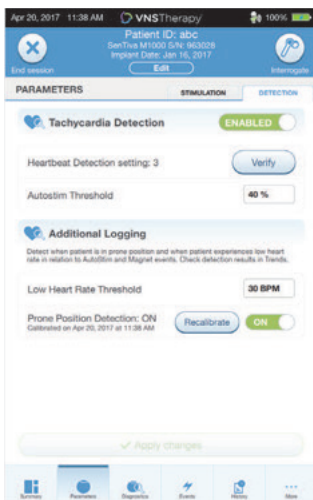
For generators capable of heartbeat detection, if AutoStim or Magnet stimulation is programmed on, the Verify Heartbeat Detection feature may be interrupted if AutoStim or Magnet stimulation is activated during the Verify Heartbeat Detection process. In this case, “?? BPM” will display on the screen. If “?? BPM” displays, LivaNova recommends you temporarily disable all output currents for generators capable of heartbeat detection (i.e. program to 0 mA) and retry the heartbeat verification. After the calibration process is completed, you may reprogram the output currents as appropriate.

To set the AutoStim Threshold:

The AutoStim Threshold is a setting on the Detection Tab that can be set from 20% to 70% (in 10% increments). This setting allows you to determine the minimum heart rate change required for AutoStim, and should be tailored to the individual patient. For the most sensitive detection and the smallest heart rate change for stimulation, choose 20%. For the least sensitive detection and thus the largest heart rate change for stimulation, choose 70%.

NOTE:

Additional guidance for how to program this patient-specific setting can be found in the VNS Therapy System Physician’s Manual.



Prone Position/Low Heart Rate Detection

To receive extra patient-specific information, you can configure the model 1000 generator to log low heart rate episodes and/or the occurrence of prone position when these events occur within 7.5 minutes of an AutoStim or Magnet Mode activation.

To enable Prone Position/Low Heart Rate Detection:

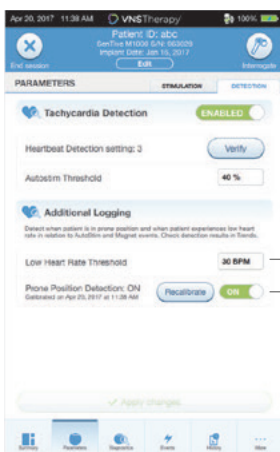
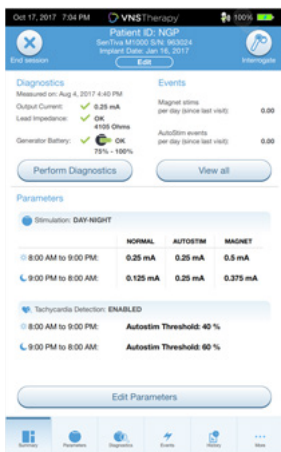
1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, or tap on **PARAMETERS** in the Navigation Bar at the bottom of the screen to go to the Parameters Screen
2. On the Parameters Screen, tap on the **DETECTION** tab:
 - Tap the **LOW HEARTRATE THRESHOLD** field and select a threshold from the pop up menu (range 30-60 BPM)
 - **APPLY CHANGES**
 - Turn on Prone Position Detection. The programmer will prompt you to calibrate the generator orientation within the body

NOTE:

Tachycardia Detection must be enabled before this feature can be enabled/programmed.

NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.



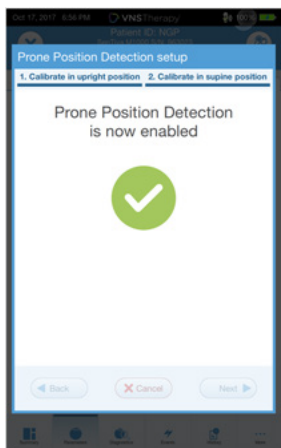
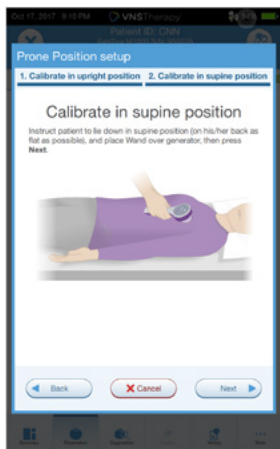
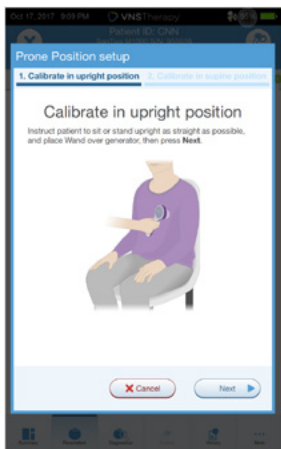
Low Heart Rate Threshold
Prone Position Toggle

To complete the Prone Position Detection setup:

1. Instruct the patient to sit or stand upright as straight as possible. Place the wand over the generator and press **NEXT** on the programmer screen
2. Instruct the patient to lie down flat on their back in the supine position. Place the wand over the generator and press **NEXT** on the programmer screen
3. Look for the on-screen confirmation that Prone Position Detection is now enabled

CAUTION:

Low heart rate and prone position events are for informational purposes only. Detected events are not to be used for alarms or medical diagnosis.



Guided Programming

Use the Guided Programming feature to adjust parameters to the next step of a standard or custom protocol. This feature simplifies programming by allowing you to increase or decrease parameters with a single button. You can exit Guided Programming at any time to adjust the parameters manually.

In Guided Programming mode, the SenTiva M1000 generator will:

- Keep the current mode, protocol, and step in memory
- Increase or decrease parameters to the next protocol step in response to a single button

NOTE:

Guided Programming mode is unavailable if Day/Night programming is enabled.

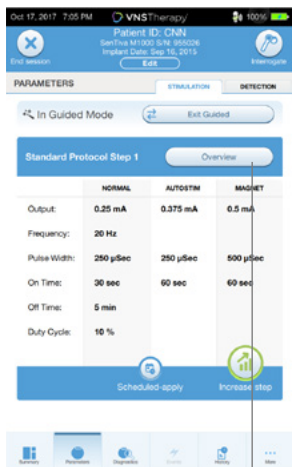
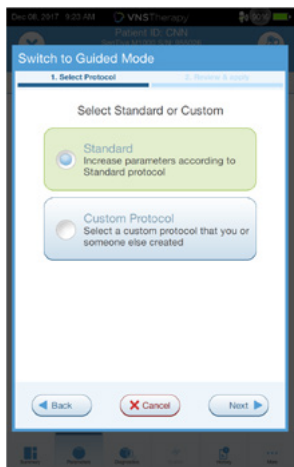
To enable Guided Programming:

1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, or tap on **PARAMETERS** in the Navigation Bar at the bottom of the screen
2. On the Parameters Screen, tap on **SWITCH TO GUIDED MODE** button at top of screen
3. On the Switch to Guided Mode Screen, select **STANDARD PROTOCOL**. There is also an option of selecting a custom protocol
4. On the Parameters Screen - Guided Mode View, follow the on-screen prompts to make selections. Tap **APPLY CHANGES** before leaving each screen



To review current therapy protocol steps:

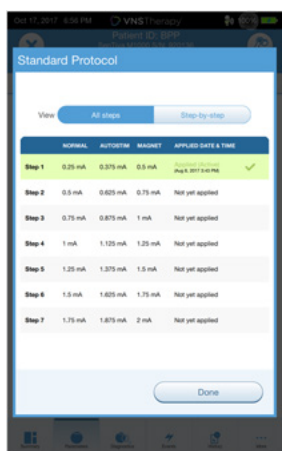
In Guided Mode view, tap on the **OVERVIEW** button on the right side of the screen



Overview

To change parameters in Guided Programming:

1. Select **INCREASE STEP** to increase parameters to the next protocol step. Tap **APPLY CHANGES** to save
2. Select **DECREASE STEP** to change the parameters to the previous protocol step. Tap **APPLY CHANGES** to save
3. To exit Guided Programming, press **EXIT GUIDED**



Decrease Step

Increase Step



Standard Protocol Steps

	Normal	AutoStim	Magnet
Step 1	0.250 mA	0.375 mA	0.500 mA
Step 2	0.500 mA	0.625 mA	0.750 mA
Step 3	0.750 mA	0.875 mA	1.000 mA
Step 4	1.000 mA	1.125 mA	1.250 mA
Step 5	1.250 mA	1.375 mA	1.500 mA
Step 6	1.500 mA	1.625 mA	1.750 mA
Step 7	1.750 mA	1.875 mA	2.000 mA

Standard Protocol Persistent Parameter Settings

	Normal	AutoStim	Magnet
Frequency	20 Hz	20 Hz	20 Hz
Pulse Width	250 μ sec	250 μ sec	250 μ sec
On Time	30 sec	60 sec	60 sec
Off Time	5 min	N/A	N/A
Duty Cycle	10%	N/A	N/A

For information on creating Custom Protocols, see page 37

NOTE:

Guided Programming mode is unavailable if Day/Night programming is enabled. In the Standard Therapy Protocol, maximum target for output current for Normal Mode is 1.750mA. Increases above that target must be done manually.

NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.

Scheduled Programming

The generator must already be in Guided Mode before Scheduled Programming can be used. Use Scheduled Programming to automatically change parameter steps according to a preset schedule. Scheduled programming may be useful to patients who live far from their healthcare provider.

To enable Guided Programming:

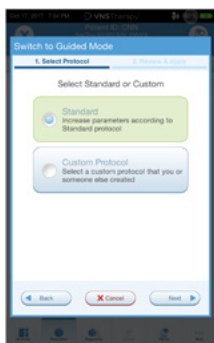
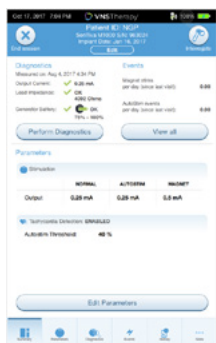
1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, or tap on **PARAMETERS** in the Navigation Bar at the bottom of the screen
2. On the Parameters Screen, tap on **SWITCH TO GUIDED MODE** button at top of screen
3. On the Switch to Guided Mode Screen, select either **STANDARD** or **CUSTOM** protocol and tap **NEXT**
4. Tap **APPLY CHANGES** to enable Guided Mode

To turn on Scheduled Programming:

1. In Guided Mode View, tap the **SCHEDULED-APPLY** button
2. On the Scheduled-Apply Screen, tap on **ENABLE NOW** at the center of the screen
3. On the next Scheduled-Apply screen, select the time interval between step increases, then tap **GENERATE SCHEDULE** at the center of the screen. Once a schedule has been generated you can follow the on-screen prompts to make adjustments to the schedule
4. Tap **APPLY CHANGES** to program your changes

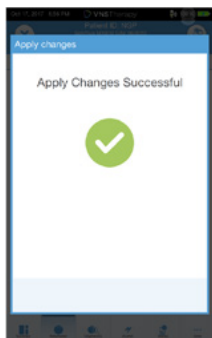
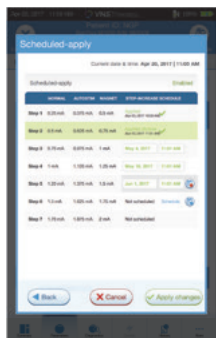
NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.





Scheduled Apply



NOTE:

If the patient resides in a different time zone or plans to travel, program the schedule based on the patient's local time zone to ensure therapy changes occur at the intended times.

NOTE:

Protocols that utilize 0.25mA increases such as the Standard Protocol require a minimum of 14 days between scheduled automatic titration steps. Custom protocols that utilize 0.125mA increases require a 7-day minimum interval between scheduled titration steps.

To exit Scheduled Programming, select **EXIT GUIDED**.

Day/Night Programming

Use Day/Night Programming to deliver two independent therapy parameter schedules at different times during a 24-hour period. In Day/Night Programming mode, the SenTiva M1000 will:

- Deliver therapy according to two independent sets of parameters
- Deliver each therapy protocol at a specified time during a 24-hour period

To enable Day/Night Programming:

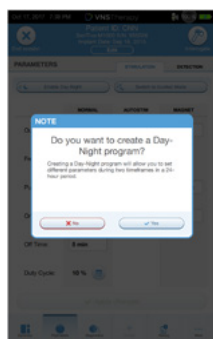
1. Confirm that the programmer date and time are correct
2. Tap on the **EDIT PARAMETERS** button, or tap on **PARAMETERS** in the Navigation Bar at the bottom of the screen
3. On the Parameters Screen, select **ENABLE DAY/NIGHT**.
When asked “Do you want to create a Day/Night program,” tap **YES**
4. On the Nighttime Tab, follow the on-screen prompts to make selections for active start and end times
5. On the Daytime Tab, the remaining hours from the 24-hour cycle are automatically shown as the daytime active period. Customize stimulation parameters as desired
6. On the **DETECTION TAB**, set AutoStim thresholds for both day and night. Tap **APPLY CHANGES**
7. On the Apply Changes Screen, review the changes made and then tap **CONFIRM**

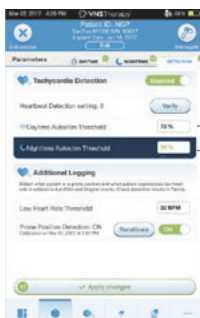
NOTE:

Day/Night Programming is only available in Manual mode and is not available in Guided Programming mode. Guided Programming mode is unavailable if Day/Night Programming is enabled. Day/Night Programming can be disabled at any time.

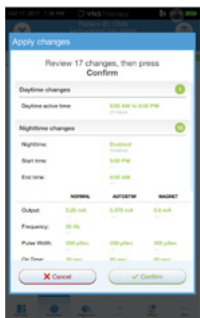
NOTE:

Time zone changes and Daylight Savings time changes must be programmed manually. The programmer does not automatically adjust for time changes.



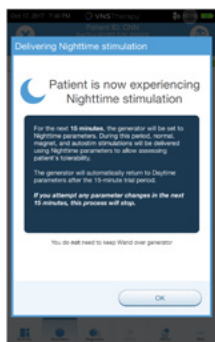
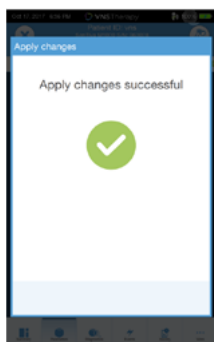
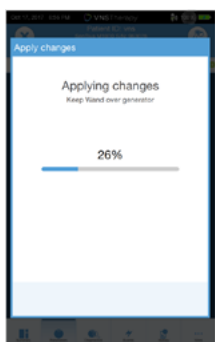


Day AutoStim
Threshold
Night AutoStim
Threshold



NOTE:

After programming, the patient will experience 15 minutes of the alternate parameter set. Assess for tolerability during this time.



NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.

Therapy Protocols

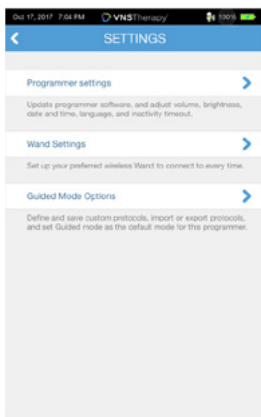
You can access, create, and manage therapy protocols from the Main Screen prior to interrogation. This allows you to define the mode, output current, and parameter settings before you begin working with a patient.

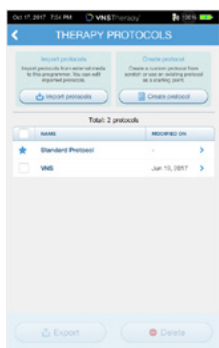
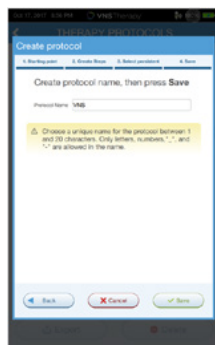
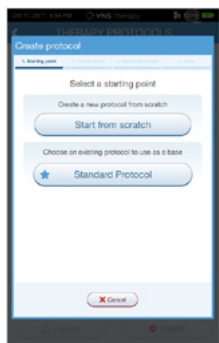
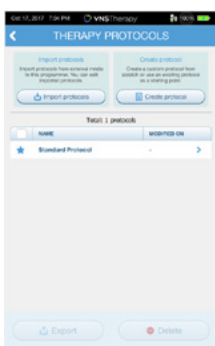
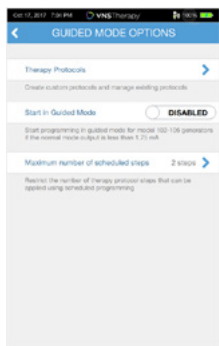
To access therapy protocols:

1. From the Main Screen, tap on the **SETTINGS** button in the Navigation Bar at the bottom of the screen
2. Tap on the **GUIDED MODE OPTIONS** button
3. From the Guided Mode Options screen, tap on **THErapy PROTOCOLS** button

To create a custom protocol:

1. From the Therapy Protocols screen, select **CREATE PROTOCOL**
2. From the Create Protocol - Select a Starting Point screen, select **START FROM SCRATCH** or choose an existing protocol as base
3. Add or delete steps (maximum of 7) and set the output currents for each therapy mode. When you are finished, tap **NEXT**
4. Choose the custom persistent parameters that will be used in all protocol steps. When you are finished, tap **NEXT**
5. Follow on-screen prompts to name the custom protocol. When you are finished, tap **SAVE**
6. From the Therapy Protocols Screen, use the **BACK** arrow to return to the Main Screen





Viewing Device Data

Use the History tab to review historical information about the patient's experience with the device. You can:

- View Summary Data
- Review Magnet Activation Counts and Timestamps
- Review Inhibited Stimulation Timestamps
- Run Daily and Hourly Histograms

NOTE:

At the end of each office visit, the generator must be interrogated by tapping the **INTERROGATE** Button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.

View History Data

Summary data are stored in several different locations:

1. To view current parameter settings:

After interrogation, parameter settings can be viewed on the Summary Screen

The screenshot shows the VNS Therapy app interface. At the top, it displays the date and time (08-17-2017 7:04 PM), the patient ID (NOSP), and the patient's name (See You M-CMO DMC, M03024). Below this, there are two main sections: Diagnostics and Events. The Diagnostics section shows measured values for Output Current (0.25 mA), Lead Impedance (OK), and Generator Battery (75% - 100%). The Events section shows Magnet status (0.00) and AutoOff events (0.00). Below these sections are buttons for 'Perform Diagnostics' and 'View all'. The Parameters section is divided into Stimulation: DAY-NIGHT and Tachycardia Detection: ENABLED. The Stimulation section shows a table with columns for NORMAL, AU/1047M, and MAGNET, and rows for 8:00 AM to 9:00 PM and 9:00 PM to 8:00 AM. The Tachycardia Detection section shows AutoOff Thresholds for 40% and 50%. At the bottom, there is an 'Edit Parameters' button and a navigation bar with icons for Summary, Parameters, Diagnostics, Events, and History.

Events

Current parameters

Events

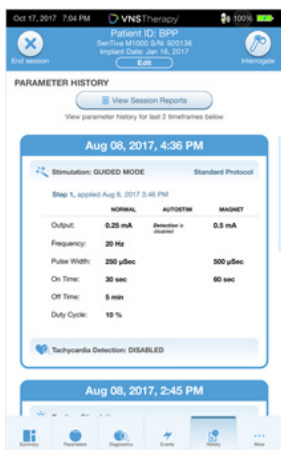
History

2. To view a history of parameters that have been used with this patient over time:

From the Summary Screen, tap on the **HISTORY** button to access these data

3. To create a session report:

Select **VIEW SESSION REPORTS**. Select the date and time of desired report



View and Export Session Reports

To view all session reports saved on the Programmer, select **REPORTS** on the navigation bar from the Main Screen. Use the search field and drop down menus to filter the reports by Date and Time, generator model, or Patient ID. Tap any session report to view.

This feature also allows you to export individual session reports to a USB drive.

To create an electronic copy (.pdf):

1. Insert external media into the Programmer USB drive (type C)
2. View the session report of interest
3. Press **EXPORT**, and follow on-screen instructions

To transfer data between Programmers, select **IMPORT/EXPORT** on the Navigation Bar from the Main Screen. This may be used to consolidate patient data between multiple computers, or to copy a custom therapy protocol from one Programmer to another.

To export a full Programmer copy do the following:

1. Insert external media into the Programmer USB drive (type C)
2. Select **EXPORT DATA**, and follow on-screen instructions

To import data to a new Programmer do the following:

1. Insert the external media containing the copied data into the “new” Programmer USB drive
2. Select **IMPORT DATA**
3. Choose the database copy that will be merged with the existing Programmer database

View Events & Trends Data

To view a summary of the therapy that was delivered between office visits:

From the Summary Screen, tap on the **EVENTS** button at the bottom of the screen to access these data.



View Last Timestamps

Review Magnet Stimulation Counts and Timestamps

To view Magnet Stimulation counts and timestamps:

1. From the Summary Screen, tap on the **EVENTS** button at the bottom of the screen
2. Tap on the **EVENTS** tab
3. Tap on **VIEW LAST TIMESTAMPS** button. The button reflects the total number of timestamps recorded. The maximum number of timestamps shown are the most recent 50 for the M1000 generator

The screenshot shows the 'Magnet Timestamps' screen. It displays two tables. The first table, 'Last 50 Magnet Stimulation timestamp(s)', has a lifetime total of 129 stimulations. The second table, 'Last 10 Magnet Inhibition timestamp(s)', has a lifetime total of 35 inhibitions. A 'Done' button is at the bottom.

DATE	TIME
Jun 20, 2017	11:42 AM
Jun 7, 2017	9:59 PM
May 28, 2017	6:22 AM
May 26, 2017	1:26 PM
May 10, 2017	5:24 PM
May 1, 2017	11:35 AM

DATE	TIME
Jun 11, 2017	9:31 AM
May 24, 2017	9:13 AM

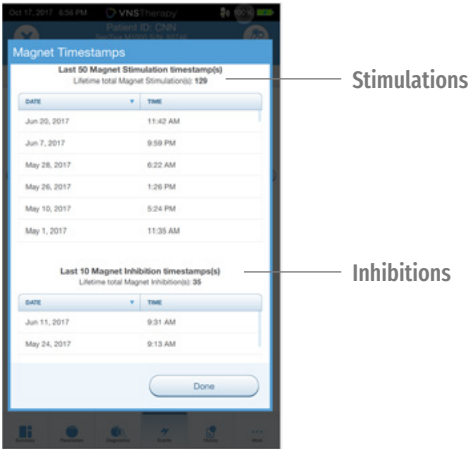
The screenshot shows the 'Magnet Timestamps' screen with a filter menu open. The menu options are: All, Today, Last 2 Days, Last 7 Days, and Last 30 Days. The background shows the same tables as the previous screenshot.

Review Inhibited Stimulation Timestamps

From the same screen where you can view the Magnet Stimulation timestamp information, you can also view the history of Magnet Inhibitions.

At the top are Magnet Stimulation timestamps and below are Magnet Inhibition timestamps.

In each case, you can select the “date” header to select the time intervals to view.



NOTE:

Ensure **ADVANCED INTERROGATION** is selected on the Main Screen in order to view Events and Trends after generator interrogation.

Review Daily or Hourly Histograms of Trend Data

You can view histograms of trend data that may include:

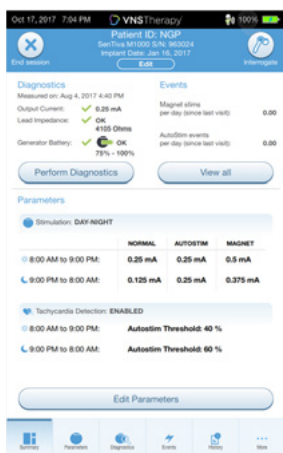
- Tachycardia detections (without stimulation)
- AutoStim stimulations
- Magnet mode stimulations
- Prone position (model 1000 only)
- Low heart rate (model 1000 only)

NOTE:

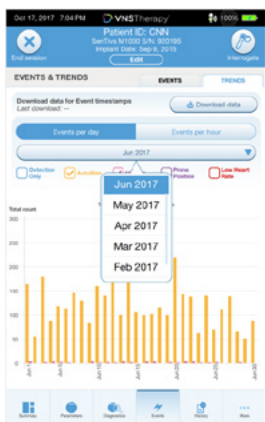
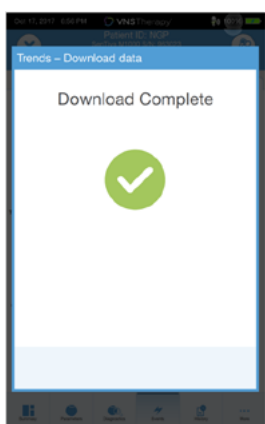
The data download is only required for M1000 if the user wants to view specific timestamps.

To view a histogram of trend data:

1. From the Summary Screen, tap on the **EVENTS** button in the Navigation Bar at the bottom of the screen, and then select the **TRENDS** tab
2. To download timestamp information from the generator, place the wand over the generator and tap the **DOWNLOAD DATA** button
3. Check the colored boxes to select the event types you want to include in your histogram
4. Tap on the button displaying the date to adjust the timeframes
5. Tap on **EVENTS PER DAY** to show one month of detection data in a day-by-day format
6. Tap on **EVENTS PER HOUR** to show detection data in an hour-by-hour format. Choose the timeframe and event types you want to display



Events



NOTE:

To view more details, tap on the individual bars in the histogram.

FUNCTIONS OF THE MAGNET

On-demand Stimulation

- Programming is typically 0.25 mA more than Normal Mode output current.
- Apply or pass the magnet (with label-side of magnet facing chest) over device for no more than 2 sec.

Inhibition

- Secure the magnet in place for > 65 secs with label-side of magnet facing chest. When removed, stimulation will resume after one full off cycle has elapsed.

Resetting

- The magnet is necessary to perform a reset with a programming wand if necessary. See the VNS Therapy Physician's Manual.
- It is recommended, except in cases of a medical emergency, that the physician consult a LivaNova technical representative before a reset is performed.

Daily Assessment of Generator Function

- Patients are instructed to swipe the magnet over the generator daily to ensure that the device is working, particularly if they do not feel it or have no voice change. The higher output current for the daily test enables the patient to more readily detect the sensation caused by the stimulation.

Evaluating Magnet Mode Stimulation

- The Magnet Mode Diagnostics can be used to assess deliverability of the magnet mode output current and the success of the initiation.
- The device retains detailed information on only the 50 most recent activations but keeps count of all successful activations.

How to Replace the LivaNova Magnets

To order a new magnet, patients should contact their doctor.

Doctors can contact LivaNova at 1.866.332.1375 to order additional magnets for patients.

END OF SERVICE

Device longevity is dependent on stimulation parameters, impedance, duration of implant, and battery voltage. Higher stimulation parameters as well as higher duty cycles affect the longevity of the device, making the projection shorter. Additional information can be found in the VNS Therapy Physician's Manual.

DEVICE DIAGNOSTICS

Several Diagnostics tests are available in the programming software to assess functionality of the implanted system. You may access them after a completed interrogation by selecting **DIAGNOSTICS**, or **PERFORM DIAGNOSTICS** on the Summary Screen.

Depending on the model of generator interrogated, you may have access to different types of tests. Typical tests include System Diagnostics, Normal Mode Diagnostics, Magnet Diagnostics, and AutoStim Diagnostics. Make sure to follow all the instructions on the Programmer screen, as they vary for each selection.



It is important to note that the tests described in this section are designed for assessing system functionality using the implanted components. Another test, Generator Diagnostics, is designed specifically for use with a test resistor and should only be accessed for troubleshooting scenarios during implantation surgery. Please see “Troubleshooting” for more details on accessing Generator Diagnostics.

The various test parameters and their values/meanings across the different diagnostics tests are summarized in the following table.

Diagnostic/Parameter Result Summary

Lead Impedance

Description: Indicates measured or estimated impedance when delivering the output current during testing and whether it's within normal range.

Values/Results: Measured lead impedance value (ohms) and overall status of OK, LOW, or HIGH

What Does the Value or Result Mean?:

OK: Impedance is within acceptable operating range.
No special attention is required.

LOW: Impedance is lower than expected and it may be indicative of a short circuit condition or a defective generator.
See "Troubleshooting" for additional instructions.

HIGH: Impedance is higher than expected and the generator may not be able to deliver the programmed therapy. See "Troubleshooting" for additional instructions.

Generator Battery

Description: Indicates battery status of the generator using one of the following:

- OK
- Intensified Follow-up Indicator (IFI)
- Near End of Service (N EOS)
- End of Service (EOS)

Values/Results: OK, IFI, N EOS, EOS

What Does the Value or Result Mean?:

OK: Battery level is within normal operating range and no special attention is required.

IFI: The battery has depleted to a level where more frequent clinical monitoring is recommended.

N EOS: The Generator should be replaced as soon as possible.

EOS: The generator is no longer supplying stimulation and immediate replacement is recommended. If the generator is not replaced, it will eventually lose the ability to communicate with the software.

Output Current/Current Delivered

Description: Indicates the stimulation output current delivered during the Diagnostics test, and the test status based on the programmed settings

Values/Results: Output current value (mA) and overall status of OK or LOW

What Does the Value or Result Mean?:

Value indicates the stimulation output delivered during the diagnostic test.

OK: Current is being delivered at the programmed level.

LOW: Programmed current is possibly not being delivered at the specified level.

CAUTION:

Battery depletion can occur between office visits. Therefore, LivaNova recommends that epilepsy patients with magnet activation enabled should perform a daily magnet activation to check stimulation. If stimulation is not felt, instruct the patient to consult with the physician to perform diagnostics testing.

All previously completed Diagnostics tests are listed in the history table on the Diagnostics screen. Use the drop down menus to filter the reports by type and/or date. Select any test to view details.

System Diagnostics

NOTE:

A System Diagnostics is performed for Model 1000 during the initial interrogation, regardless of the type of interrogation (Advanced or Rapid). The results are displayed on the Summary Screen and logged as part of Diagnostics history. To perform a diagnostic test for a Model 1000 after the initial interrogation you can manually perform a System Diagnostic test while in session.

The System Diagnostics test assesses the electrical continuity between the generator and the bipolar lead when connected. The test measures the generator's ability to deliver programmed output current and the lead impedance status. You can perform this test on all generators supported by the Programming System during implantation and patient follow-up visits. A successful System Diagnostics during surgery or post-implant shows that both the generator and lead are working properly. LivaNova recommends you perform a System Diagnostics test before other diagnostic tests.

Magnet Mode Diagnostics

The Magnet Mode Diagnostics test will let you know if the generator is able to deliver the programmed magnet output current. To perform this test do the following:

1. Select **TEST MAGNET**
2. Quickly pass the magnet over the generator (no more than 2 seconds)
3. Place the wand over the generator and use the on-screen button to start the test.

If you do not successfully activate magnet stimulation, a message will display on the screen indicating the magnet presence was not detected. Pass the magnet over the generator again and restart the test.

AutoStim Diagnostics

The AutoStim Diagnostics test determines if the generator is able to deliver the programmed AutoStim output current. The desired AutoStim output current should be programmed before you perform the diagnostic test.

Generator Diagnostics

The Generator Diagnostics test is designed specifically for use with a test resistor and should only be accessed for troubleshooting scenarios during implantation surgery. Go to “Troubleshooting” for more details on using Generator Diagnostics.

NOTE:

Once programmed ON, lead impedance measurement readings are automatically performed once every 24 hours for Model 103 and higher generators. Results from the 24-hour impedance check will be reported on the Summary Screen upon initial interrogation.

IN THE OPERATING ROOM

The programmer and the programming wand can be connected wirelessly or with a backup USB cable.

NOTE:

At the end of parameter adjustment in the Operating Room, the generator must be interrogated by tapping the **INTERROGATE** button followed by tapping the **END SESSION** button to ensure creation and accuracy of the session reports.

Initial Implant Overview

1. Conduct ECG to select implant location
2. Perform preoperative system checks
3. Program Patient ID and implant date
4. Access and expose the vagus nerve
5. Create the generator pocket
6. Tunnel the lead
7. Place the electrodes
8. Add strain relief and tie downs
9. Connect the generator and lead
10. Perform System Diagnostic #1
11. Insert generator into pocket
12. Turn heartbeat detection ON (for M106 and M1000 only)
13. Verify heartbeat detection setting
14. Select AutoStim threshold
15. Secure generator to fascia
16. Perform System Diagnostic #2 and final interrogation
17. Close incisions

Perform Preoperative System Checks

BEFORE the surgery, prepare the VNS Therapy® System:

1. Charge the programmer
2. Turn the programmer ON
3. Check the programmer battery: Check the battery status on the battery indicator at the top right corner of the programmer screen
4. Check the wand batteries: Confirm that the wand batteries are not low
5. Change the date and time if necessary. Accurate patient and device history stored in the programmer depend on correct date and time settings
6. Connect the wand to the programmer
7. Interrogate the generator (check communication between the programmer and the generator)

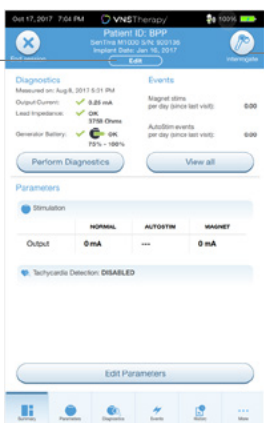
Program Patient ID and Implant Date

Enter or edit the patient data in the programmer during the preoperative preparation, immediately before surgery. In the Operating Room you will be prompted to enter the ID upon initial interrogation with the generator.

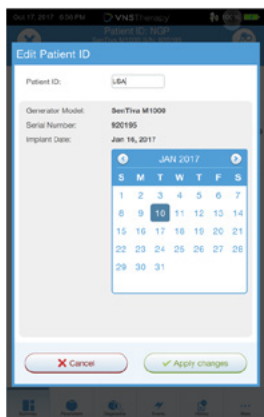
To enter or edit patient data:

1. Connect the wand to the programmer and interrogate the generator
2. On the Summary Screen, review the patient and generator information that is displayed in the blue Patient ID bar at the top of the screen. Tap the **EDIT** button below the patient information
3. On the Edit Patient ID screen, enter or change information as needed
4. Tap **APPLY CHANGES** and **CONFIRM** to enter the data

Edit
Button



Patient
ID Bar

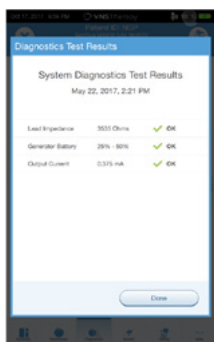
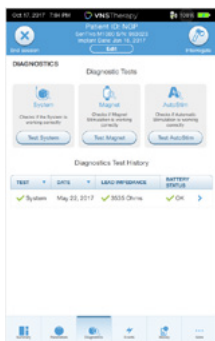


Perform System Diagnostic #1

System Diagnostic #1 tests the continuity of the lead and confirms delivery of the programmed output current to the vagus nerve.

To perform System Diagnostic #1:

1. From the Summary Screen, tap on the **PERFORM DIAGNOSTICS** button, OR tap on the **DIAGNOSTICS** button in the Navigation Bar
2. On the Diagnostics screen, tap **TEST SYSTEM** to start the test and confirm that the system is working correctly
3. Review the Diagnostics Test results and tap **DONE**

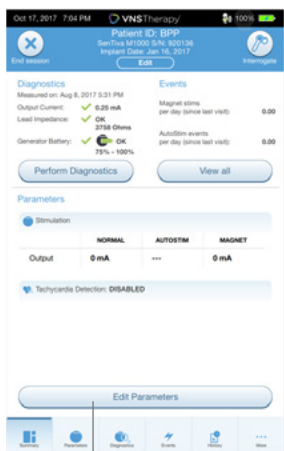


Turn Tachycardia Detection ON

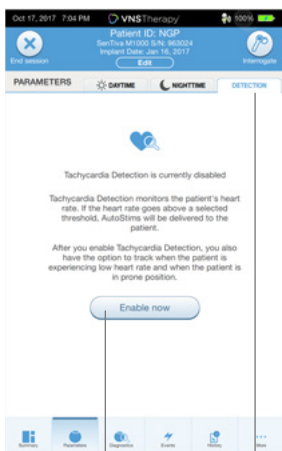
Tachycardia Detection can be turned on from the Edit Parameters screen.

To turn Tachycardia Detection ON:

1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, OR tap on the **PARAMETERS** button in the Navigation Bar at the bottom of the screen
2. On the Parameters Screen, select the Detection Tab and then tap on **ENABLE NOW** to turn on Tachycardia Detection



Edit Parameters



Enable Now

Detection Tab

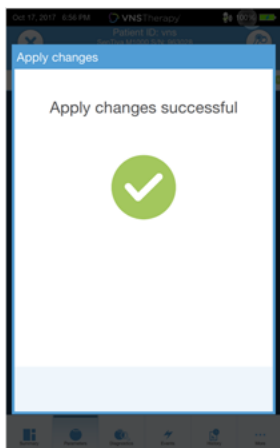
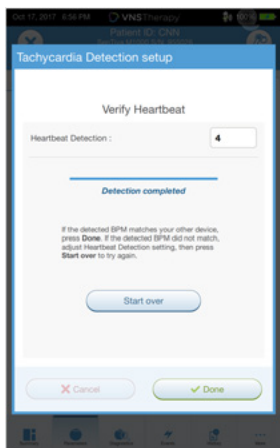
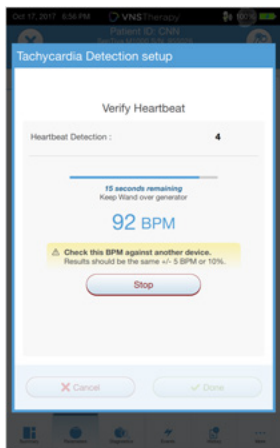
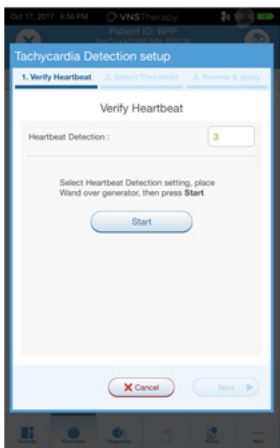
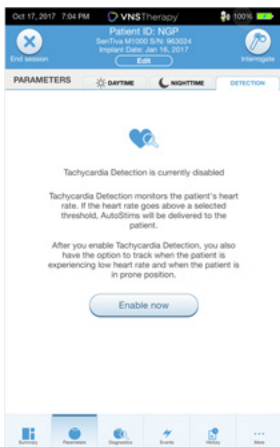
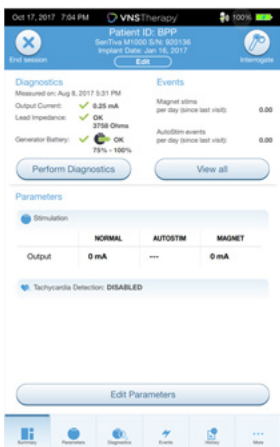
Verify Tachycardia Detection Setting

To verify the Tachycardia Detection setting:

1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, OR tap on the **PARAMETERS** button in the Navigation Bar at the bottom of the screen
2. On the Edit Parameters screen, select the Detection Tab and confirm that Tachycardia Detection is enabled. Verify the Heartbeat Detection Setting by tapping the **VERIFY** button. If Detection has not been enabled, click on the **ENABLE NOW** button to enable Detection
3. On the Tachycardia Detection Setup screen, select a Heartbeat Detection Setting between 1 and 5. Small ECG signals need high amplification (e.g. setting 5), while large ECG signals do not (e.g., setting 1)
4. Keep the wand over the generator and press **START** on the programmer screen to begin the test. Wait at least 10 seconds for the reading to stabilize
5. Compare the heart rate measured by the system in beats per minute (BPM) to the actual heart rate of the patient, and adjust the Heartbeat Detection Setting until the system displays an accurate heart rate
6. Review changes, and then tap **NEXT**

NOTE:

Tachycardia Detection Setup (Step#3) is performed in the Operating Room during initial setup. This will only be required to be performed in the office if this step was not completed in the Operating Room or if an adjustment is required post implantation.

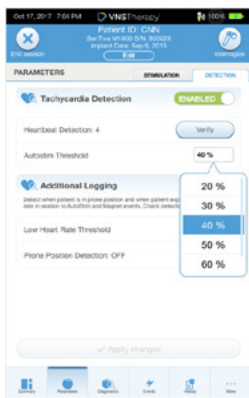
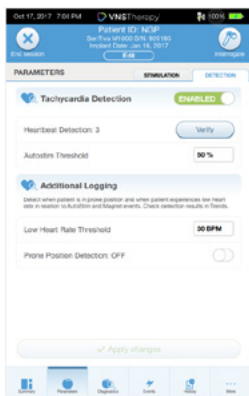
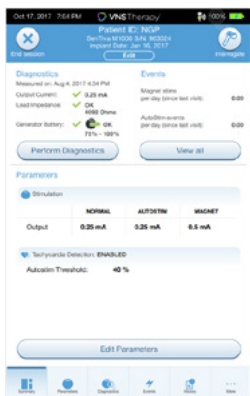


Select AutoStim Threshold

The AutoStim Threshold is the percent heart rate increase over baseline that is required to trigger automatic stimulation (AutoStim). Values range from 20% (most sensitive) to 70% (least sensitive) and should reflect the magnitude of heart rate increase associated with the patient's seizure.

To select the AutoStim Threshold:

1. From the Summary Screen, tap on the **EDIT PARAMETERS** button, OR tap on the **PARAMETERS** button in the Navigation Bar at the bottom of the screen
2. On the Parameters Screen, tap on the Detection Tab and confirm that Tachycardia Detection is enabled
3. Select an AutoStim Threshold. The threshold is the amount of heart rate increase needed to trigger an AutoStim (in the range of 20% to 70% increase from baseline)
4. Tap **APPLY CHANGES**



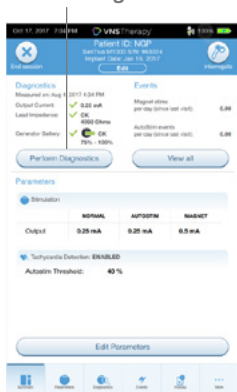
Perform System Diagnostic #2 and Final Interrogation

Before closing, perform Diagnostic Test #2 to confirm that the system is working properly and delivering the programmed output current.

To perform System Diagnostic #2 and Final Interrogation:

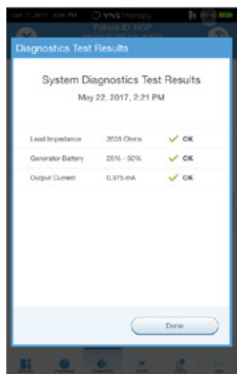
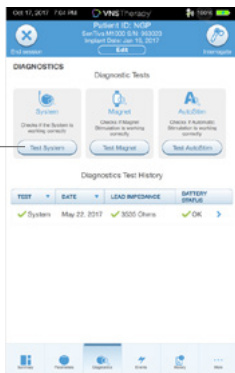
1. From the Summary Screen, tap on the **PERFORM DIAGNOSTICS** button, OR tap on the **DIAGNOSTICS** button in the Navigation Bar at the bottom of the page
2. On the Diagnostics screen, tap **TEST SYSTEM** to start the test
3. Review the results, tap **DONE**
4. Tap **INTERROGATE** button on the top right corner of the screen and then tap the **END SESSION** button at the top left of the screen

Perform Diagnostics Button



Diagnostics Button

Test System



NOTE:

At the end of parameter adjustment in the operating room, the generator must be interrogated by tapping **INTERROGATE** followed by tapping **END SESSION** to ensure creation and accuracy of session reports.

General Dosing Guidelines

SENTIVA DOSING GUIDELINES

Phase 1: Output Current

Increase Output Current to therapeutic effect as tolerated by the patient

NORMAL MODE: 0.25 mA steps to therapeutic effect^{1,2}

AUTOSTIM MODE*: Normal Mode + 0.125 mA
AutoStim should be comfortable for patients

MAGNET MODE: Normal Mode + 0.25 mA
Magnet Mode should be > than AutoStim Mode

STANDARD PROTOCOL

	Visit	1	2	3	4	5	6	7
NORMAL	Output Current	0.25	0.5	0.75	1.0	1.25	1.5	1.75
	Signal Frequency	20	20	20	20	20	20	20
	Pulse Width	250	250	250	250	250	250	250
	Signal ON Time	30	30	30	30	30	30	30
	Signal OFF Time	5	5	5	5	5	5	5
AUTOSTIM	Output Current	0.375	0.625	0.875	1.125	1.375	1.625	1.875
	Pulse Width	250	250	250	250	250	250	250
	ON Time	60	60	60	60	60	60	60
MAGNET	Output Current	0.5	0.75	1.0	1.25	1.5	1.75	2.0
	Pulse Width	500	500	500	500	500	500	500
	ON Time	60	60	60	60	60	60	60

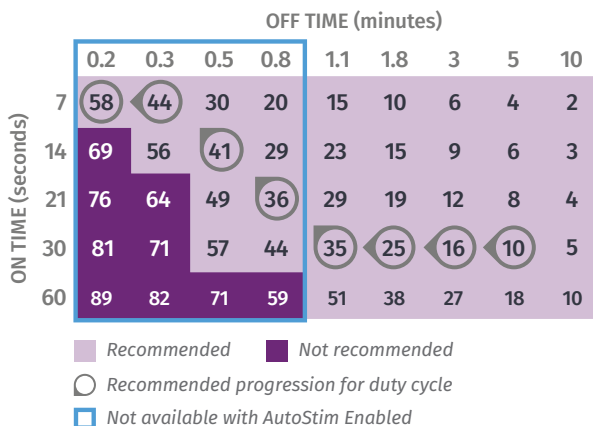
- Suggested programming settings ≥ 2 weeks post-op
- More frequent visits (1 - 2 weeks) are suggested in Phase 1
- Multiple 0.25 mA increases may be made in a single visit to reach therapeutic range sooner; ensure patient tolerability before making additional adjustments

Dosing Notes

- Continue to optimize dose to therapeutic effect or tolerability
- Give patient time to adapt to parameter changes before making additional adjustments

Phase 2: Duty Cycle

- Increase duty cycle over time and assess clinical outcome
- Adjustments to duty cycle should be less frequent (3 - 6 months)



LivaNova recommends that stimulation with Normal Mode ON time > OFF time be avoided. Duty Cycle = (ON Time + 4 seconds) / (ON time + OFF Time), for which ON and OFF Time are measured in seconds.

Additional Settings for SenTiva

Tachycardia Detection	ON/OFF
Heartbeat Detection* Range (1 - 5)	Start with Sensitivity 1 and verify heartbeat detection update. Adjust setting if necessary until accurate detection is reached.
Threshold for AutoStim* (% heart rate increase) Range (20 - 70%)	Set at or below the patient's typical heart rate increase during a seizure If not available, start with 20% and adjust based on clinical benefit or tolerability
Prone Position*	Configure generator to log the occurrence of prone position when they occur within 7.5 minutes of an AutoStim or Magnet Mode activation
Low Heart Rate* Range (30-60 BPM)	Configure generator to log low heart rate episodes when they occur within 7.5 minutes of an AutoStim or Magnet Mode activation

*Tachycardia detection must be enabled

Strategies to Manage Side Effects

- Evaluate tolerability after each adjustment
- Side effects typically decrease over time^{3,4}

RECOMMENDED ORDER	
1. Pulse Width	If 500 → 250 μsec^{\pm}
2. Signal Frequency	If 30 → 25 or 20 Hz ⁵
3. Output Current	↓ 0.125 mA ↓ 0.25 mA

FOR AUTOSTIM-RELATED SIDE EFFECTS*	
1. Verify Heartbeat Detection	Adjust Heartbeat Detection sensitivity, if necessary
2. AutoStim Parameters	↓ Pulse Width ↓ Output Current (0.125 mA) ↓ ON Time
3. Threshold for AutoStim	↑ 10%

Additional Information

Please see important safety information or visit www.VNSTherapy.com.

The VNS Therapy System is indicated for use as an adjunctive therapy in reducing the frequency of seizures in patients 4 years of age and older with partial onset seizures that are refractory to antiepileptic medications.

Incidence of adverse events following stimulation (>5%) were voice alteration, increased coughing, pharyngitis, paresthesia, dyspnea, dyspepsia, and nausea.

This information is not intended to serve as a substitute for a complete and thorough understanding of the material presented in the Physician's Manuals for the VNS Therapy system and its component parts and does not represent full disclosure of all pertinent information concerning the use of this product, potential safety complications, or efficacy outcomes.

REFERENCES: 1. Helmers SL, et al. Application of a computational model of vagus nerve stimulation. *Acta Neurol Scand.* 2012 Nov;126(5):336-43. 2. Heck C, Helmers SL, DeGiorgio CM. Vagus nerve stimulation therapy, epilepsy, and device parameters: scientific basis and recommendations for use. *Neurology.* 2002 Sep 24;59(6 Suppl 4):S31-7. 3. Morris GL III, Mueller WM. The Vagus Nerve Stimulation Study Group E01-E05. Long-term treatment with vagus nerve stimulation in patients with refractory epilepsy. *Neurology.* 1999;53(7):1731-1735. 4. Ben-Menachem E. Vagus nerve stimulation, side effects, and long-term safety. *J Clin Neurophysiol.* 2001;18(5):415-418.

SenTiva MRI Guidelines

Scan Conditions - SenTiva® Model 1000

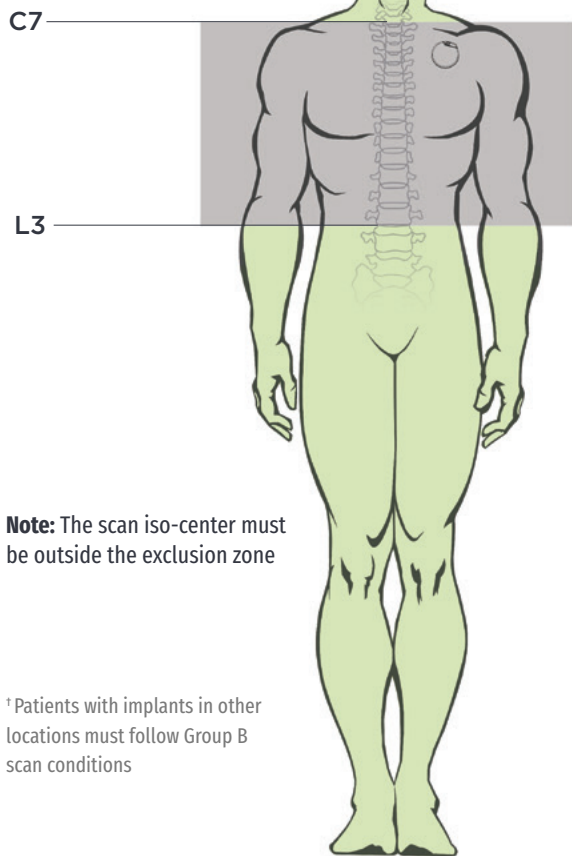
No special MRI equipment/coils required

GROUP A

 Permissible Scan Area

 MRI Exclusion Zone

Generator in upper left chest, at or above armpit (above rib 4)[†]



Note: The scan iso-center must be outside the exclusion zone


[†] Patients with implants in other locations must follow Group B scan conditions



Imaging techniques such as computed tomography, x-ray, and ultrasound are safe to perform in the MRI exclusion zone.

Review the most current labeling prior to performing an MRI scan. For full MRI safety information, refer to MRI Instructions for Use at www.easy-mri.com

GROUP A

 MR Conditional	Yes
Static Magnet Strength	1.5T or 3T
Scanner Type	Horizontal field, cylindrical closed-bore 1.5T or 3T scanner
Operating Mode	Normal Operating Mode
Exclusion Zone	Body coil: C7-L3 Transmit-receive head or extremity coil: C7-T8
Max Spatial Gradient	≤3000 Gauss/cm
Max Slew Rate	200 T/m/s
RF Coil	Transmit: Body coil or Transmit-receive head or extremity coils Receive: No Restrictions
Max SAR	Transmit head coil: 3.2 W/kg Transmit body coil: 2.0 W/kg
System Programming	Stimulation OFF Sensing OFF* *for select models with AutoStim mode Optional device features OFF (Model 1000 only)
Exposure Time	Transmit head or extremity coil: No restrictions Transmit body coil: ≤ 15 minutes of active scan time within a 30 minute window
Additional Restrictions	Transmit head or extremity coil: none Transmit body coil: Circularized Polarized mode only



For full MRI safety information, the VNS Therapy System Physician's Manual can be found at www.easy-mri.com
For technical product questions, contact LivaNova Technical Services at 1-866-882-8804

Scan Conditions - SenTiva® Model 1000 implanted lower than rib 4 (below armpit level)

Requires local transmit-receive coil

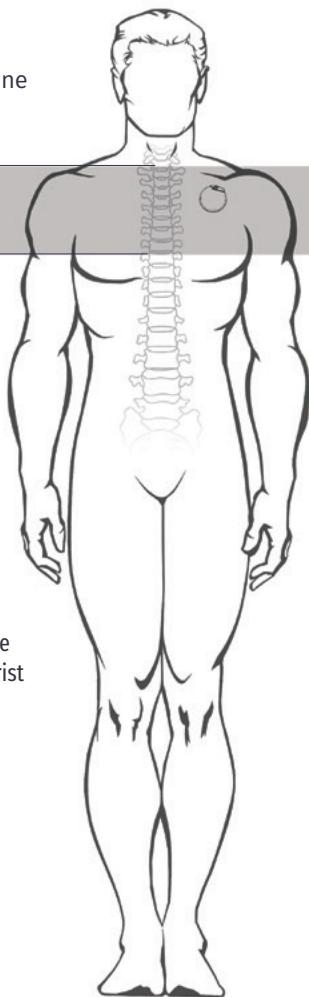
Availability may vary

GROUP B

● MRI Exclusion Zone

C7

T8




Permissible scans include
head, knee, ankle, and wrist



Imaging techniques such as computed tomography, x-ray, and ultrasound are safe to perform in the MRI exclusion zone.

Review the most current labeling prior to performing an MRI scan. For full MRI safety information, refer to MRI Instructions for Use at www.easy-mri.com

GROUP B

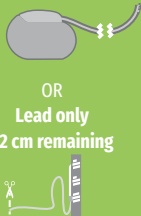


 MR Conditional	Yes
Static Magnet Strength	1.5T or 3T
Scanner Type	Horizontal field, cylindrical closed-bore 1.5T or 3T scanner
Operating Mode	Normal Operating Mode
Exclusion Zone	C7-T8
Max Spatial Gradient	≤3000 Gauss/cm
Max Slew Rate	200 T/m/s
RF Coil	Transmit-receive head or extremity coils
Max SAR	Transmit-receive head coil: 3.2 W/kg
System Programming	Stimulation OFF Sensing OFF* *for select models with AutoStim mode Optional device features OFF (Model 1000 only)
Exposure Time	Transmit head or extremity coil: No restrictions
Additional Restrictions	None



For full MRI safety information, the VNS Therapy System Physician's Manual can be found at www.easy-mri.com

For technical product questions, contact LivaNova Technical Services at 1-866-882-8804

Special Cases

	<p>Suspected Lead Break</p> 	<p>Lead only ≤ 2 cm remaining*</p> 
Exclusion Zone	C7-T8	None
 MR Conditional	Yes	Yes
Static Magnet Strength	1.5T or 3T	1.5T or 3T
Operating Mode	Normal Operating Mode	Normal Operating Mode
Max Spatial Gradient	≤3000 Gauss/cm	≤3000 Gauss/cm
Max Slew Rate	200 T/m/s	200 T/m/s
RF Coil	Transmit-Receive head or extremity coil only	<p>Transmit: Body or transmit-receive head or extremity coils</p> <p>Receive: No Restrictions</p>
Max SAR	<p>Transmit/receive head coil: 3.2 W/kg</p>	<p>Transmit head coil: 3.2 W/kg</p> <p>Transmit body coil: 2.0 W/kg</p>

To ensure effective communication with the MRI center, complete the Patient MRI Form. Send with the patient to their MRI appointment. Download from easy-mri.com

Pre-MRI Instructions

An appropriate healthcare professional with access to a VNS Therapy programming system must prepare the VNS Therapy generator before the patient enters an MR system room.

1. Interrogate the VNS Therapy generator* and record the generator settings
2. Perform System Diagnostics to ensure proper operation of the generator
3. Reprogram the Output Current parameter settings for Normal Mode, Magnet Mode, and AutoStim Modet as follows:
 - Output Current (mA): 0.0
 - Magnet Current (mA): 0.0
 - AutoStim Current (mA): 0.0 and Tachycardia Detection “OFF”
4. Turn off any other optional device features (Model 1000 only)
5. Interrogate the generator* to verify that programming was successful
6. Verify that placement of the VNS Therapy system is located between the C7 and T8 vertebrae

Post-MRI Instructions

After the MRI procedure, an appropriate healthcare professional with access to a VNS Therapy programming system should assess the condition of the VNS Therapy system.

To assess the VNS Therapy system:

- Interrogate the VNS Therapy generator
- If the generator was reset during the scan, reprogram the serial number, patient ID, and implant date, as needed
- Program the patient’s therapeutic parameters as they were before the MRI procedure
- Perform System Diagnostics. Results should indicate Impedance=OK
- Interrogate the generator again to confirm that reprogramming was successful

* When an interrogation is performed by the programming software, the generator serial number, implant date, stimulation parameters, and generator operating time are automatically logged in the programmer database. This information may be retrieved from the database at any time after interrogation.

† for select models with AutoStim mode

The device has been evaluated for MRI induced risks, including heating, unintended stimulation, force, torque, device malfunction and device vibration and has been determined to be safe under the conditions specified in labeling; however, the patient may feel sensations of warmth or vibration at the implant site during the MRI scan.

For full MRI safety information, the VNS Therapy System Physician’s Manual can be found at www.easy-mri.com. For technical product questions, contact LivaNova Technical Services at 1-866-882-8804

Troubleshooting

This section provides steps to resolve error conditions with the programming system components or with the implanted generator and lead. For other programming system issues not addressed in this section, please contact LivaNova.

Contact Us

General Inquiries (for questions about LivaNova, LivaNova products, warranties, etc. or to request a call from a company representative)
<http://www.livanova.com/contact-us/>

24-hour Technical Support (for technical questions with programmer, generator, or wand)

- 1 (866) 882-8804 (US and Canada)
- 1 (281) 228-7330 (Worldwide)
- 32 2 790 27 73 (Europe/EMMEA)

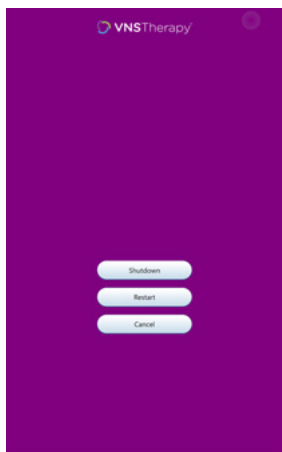
Mailing Address

LivaNova USA, Inc (formerly Cyberonics, Inc.)
100 Cyberonics Boulevard
Houston, TX 77058 USA

LivaNova Belgium NV
Ikaroslaan 83 B-1931
Zavantem, BELGIUM

Screen Freeze

1. Press and hold **POWER** button on the programmer for at least three seconds; release and follow onscreen instructions to shut down the tablet
2. If the computer does not shut down, press and hold **POWER** button to force a shutdown (may take 10+ seconds)
3. Restart the programmer

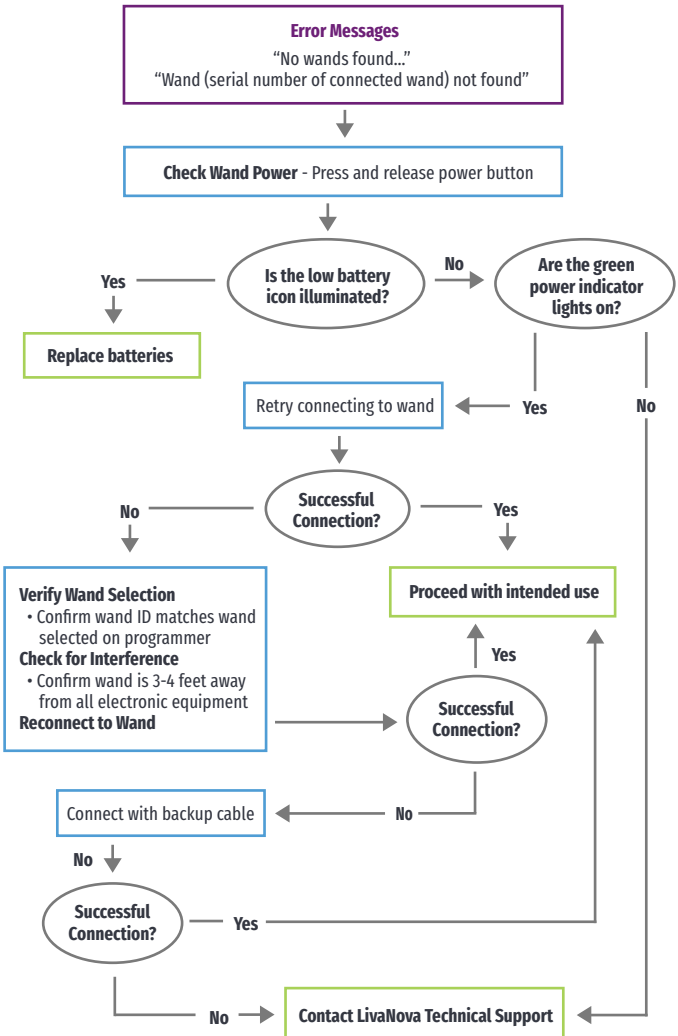


Wand Connection or Communication Issues

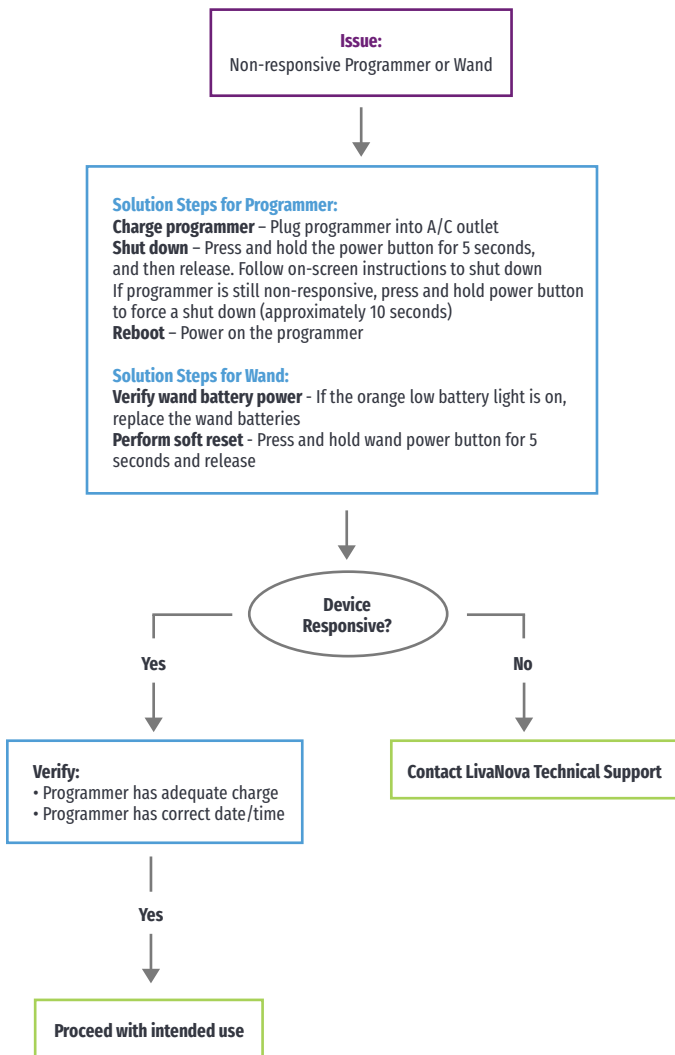
WAND NOT CONNECTING TO PROGRAMMER (WIRELESS)

Potential reasons for no wireless connection between the Wand and the Programmer include the following:

- Wand not powered on
- Depleted Wand batteries
- Electromagnetic interference (EMI), such as OR lights
- Defective Wand or Programmer



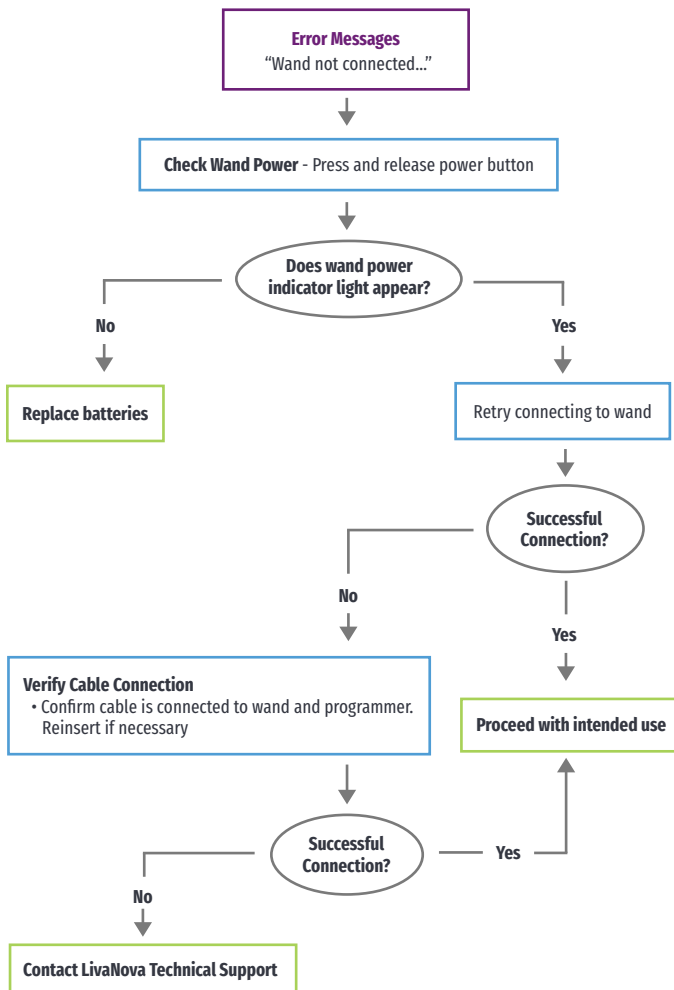
ANOMALOUS BEHAVIOR OR NON-RESPONSIVE SYSTEM



WAND NOT CONNECTING TO PROGRAMMER (BACKUP CABLE)

Potential reasons for no connection between the Wand and the Programmer via backup cable include the following:

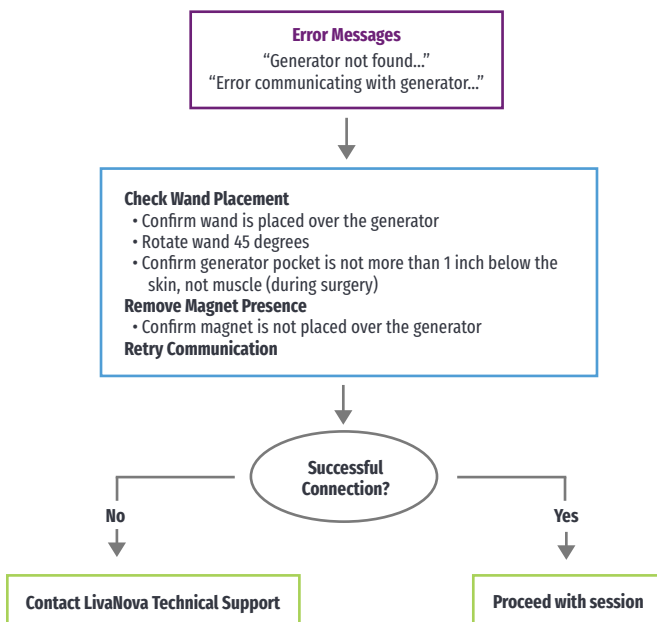
- Improper cable connection between Wand and Programmer
- Depleted Wand batteries
- Improper USB port recognition of the Programmer cable
- Defective Wand or Programmer



WAND NOT COMMUNICATING WITH GENERATOR

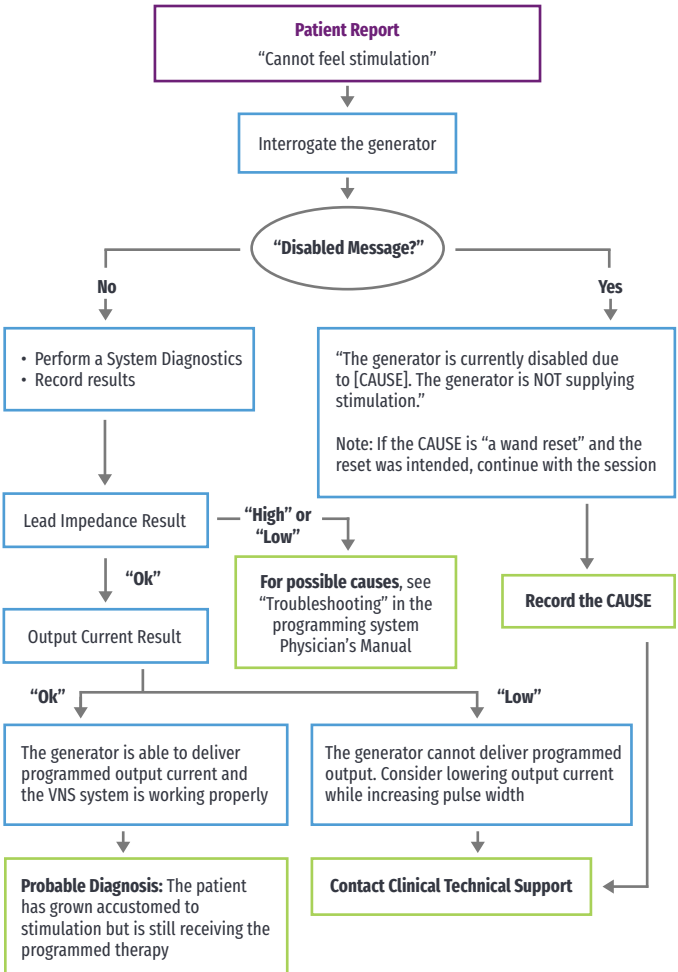
Potential causes for communication issues between the Wand and generator include the following:

- Depleted Wand batteries
- Moving Wand away from generator during communication
- Electromagnetic interference (EMI), such as OR lights
- Generator battery at End of Service (EOS)
- Magnet placed over generator
- Defective Wand, Programmer, or generator



Patient Cannot Feel Stimulation

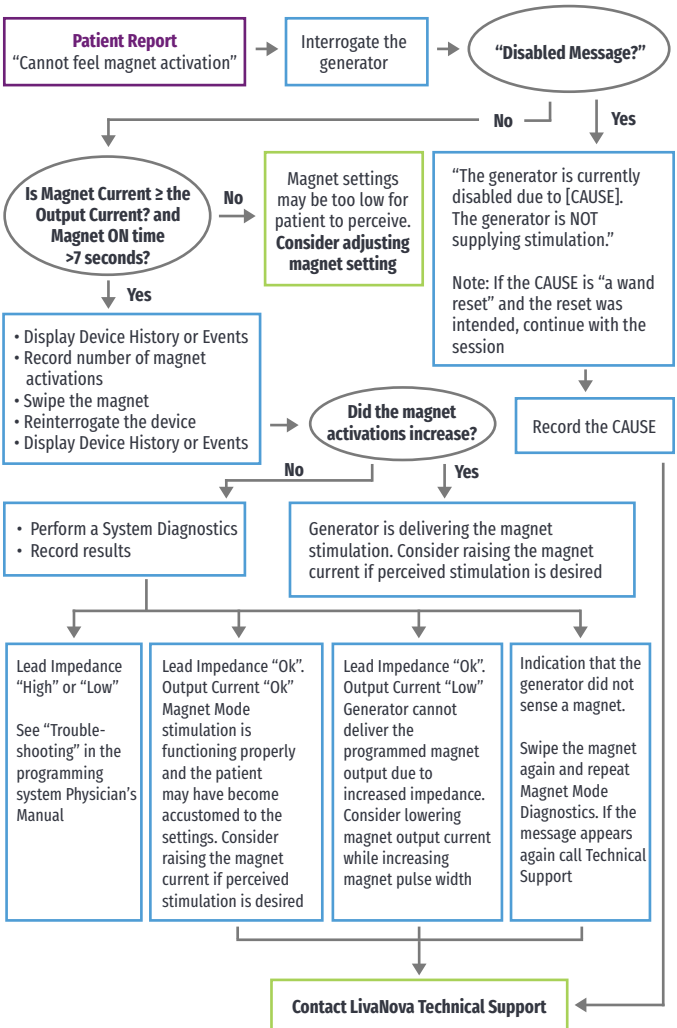
- Possible causes:
 - Patient has become accustomed to the programmed setting
 - Generator battery at end of service (EOS)
 - “High” lead impedance, defective, or disabled generator
 - Short-circuit condition within the lead
- For more detailed information, consult the Troubleshooting section of the VNS Therapy® System Physician’s Manual



Patient Cannot Feel Magnet Stimulation

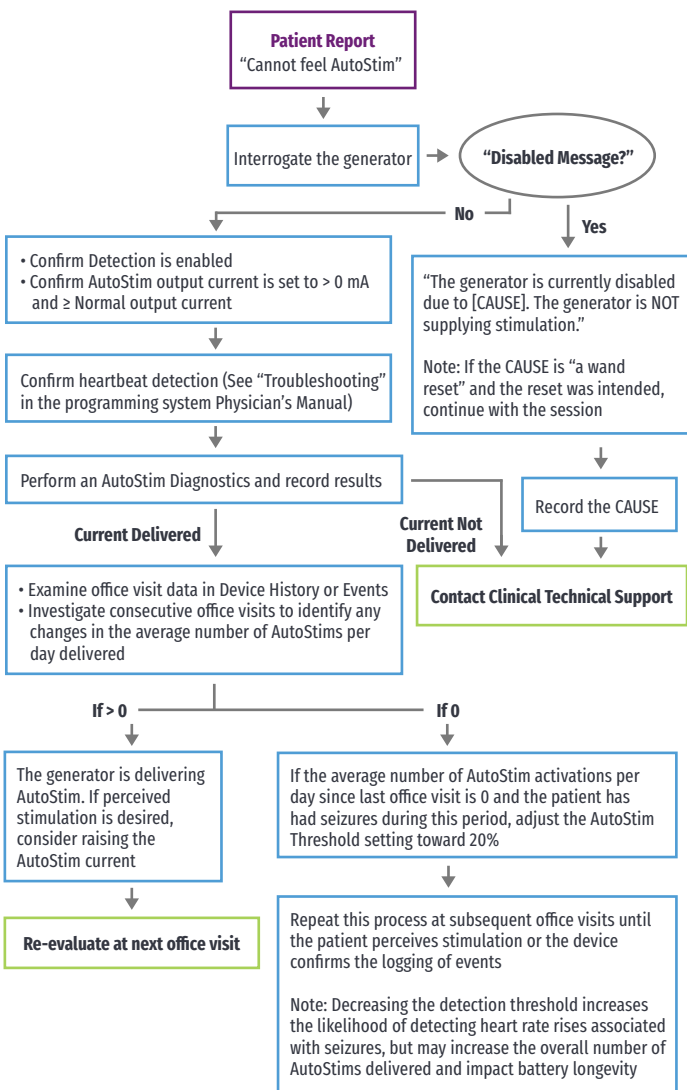
• Possible causes:

- Patient has become accustomed to the programmed setting
- Incorrect technique for swiping magnet
- Magnet output current is programmed to 0 mA
- Generator battery at end of service (EOS)
- Device implanted too deep in the chest
- Defective generator or disabled generator
- “High” lead impedance
- Short-circuit condition within the lead



Patient Does Not Perceive AutoStim Activation

- Possible causes:
 - AutoStim Threshold is too high (e.g., 70% threshold versus 50%)
 - Patient has become accustomed to the programmed setting
 - AutoStim output current is programmed to 0 mA
 - Generator battery at end of service (EOS)
 - Defective generator or lead
 - Disabled generator

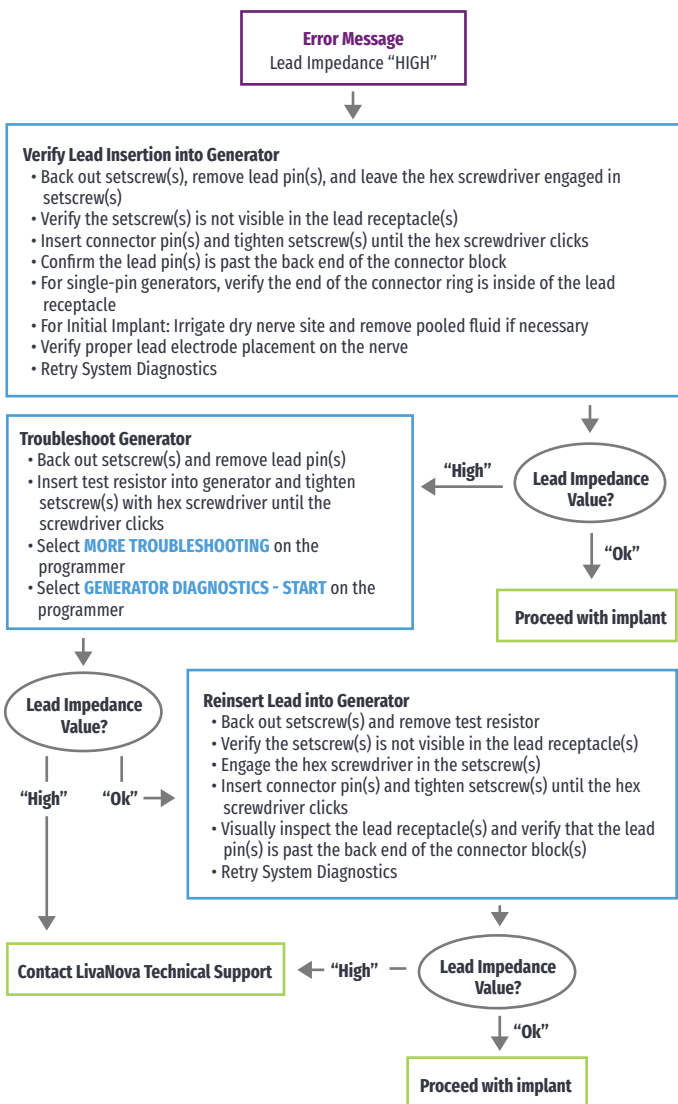


High/Low Lead Impedance and Low Output Current Issues

HIGH LEAD IMPEDANCE IN THE OR

If a System Diagnostics test results in high lead impedance, the following are possible causes:

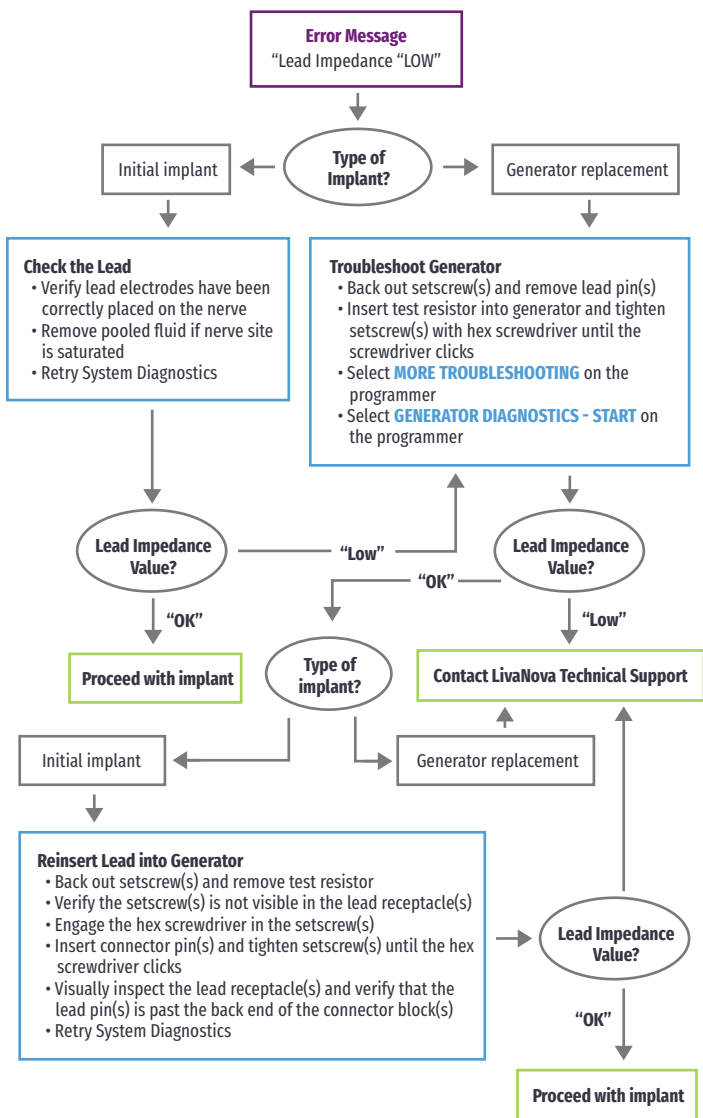
- Improper connection between the lead and the generator
- Incorrect placement of lead on the nerve (initial implant only)
- Allowing nerve to become dry (initial implant only)
- Defective lead or generator



LOW LEAD IMPEDANCE IN THE OR

If a System Diagnostics test results in low lead impedance, the following are possible causes:

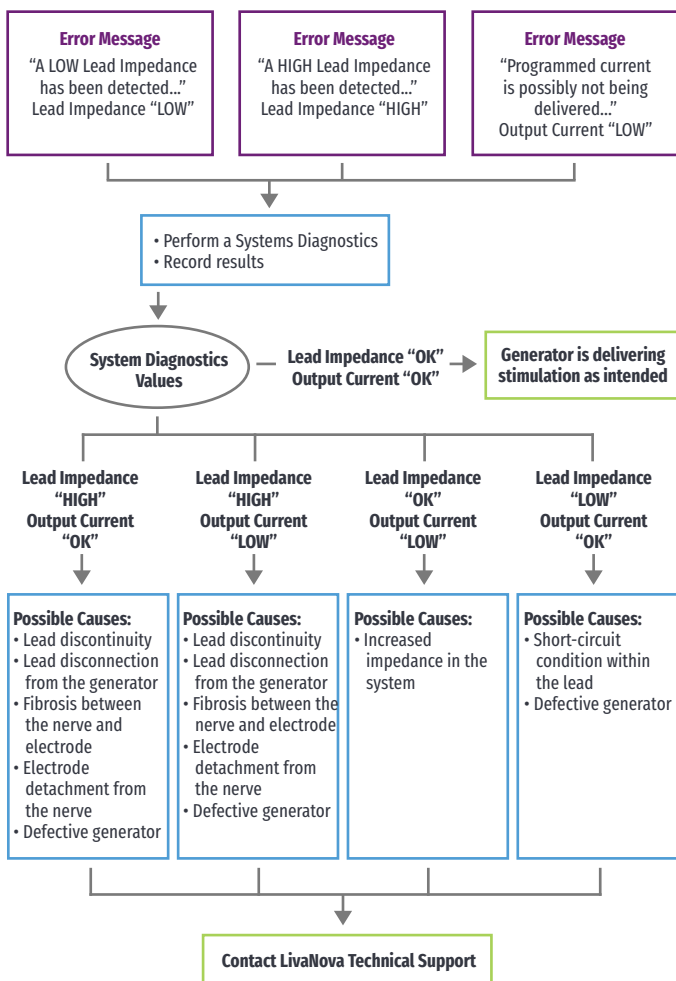
- Incorrect placement of the lead on the nerve
- Excessive irrigation of the nerve
- Defective generator or lead
- Short-circuit condition within the lead (during generator replacement surgery)



HIGH/LOW LEAD IMPEDANCE OR LOW OUTPUT CURRENT AT FOLLOW-UP VISIT

Possible causes for high or low lead impedance or low output current at follow-up visits for the model 1000 generator include the following:

- Lead discontinuity
- Lead disconnected from generator
- Fibrosis between nerve and electrode
- Electrode detachment from nerve
- Defective generator
- Short-circuit condition within the lead



Generator Battery Issues

LOW BATTERY/END OF SERVICE INDICATIONS IN OR

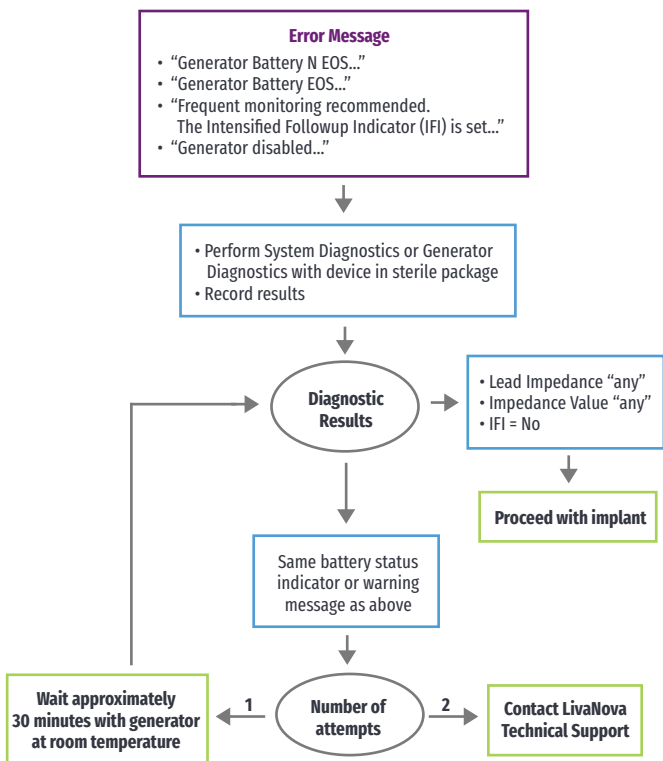
If a generator displays a low battery or End of Service (EOS) indicator while implanting, the possible causes include the following:

Prior to Surgery:

- Generator has been recently exposed to low storage temperatures
- Defective generator

During Surgery:

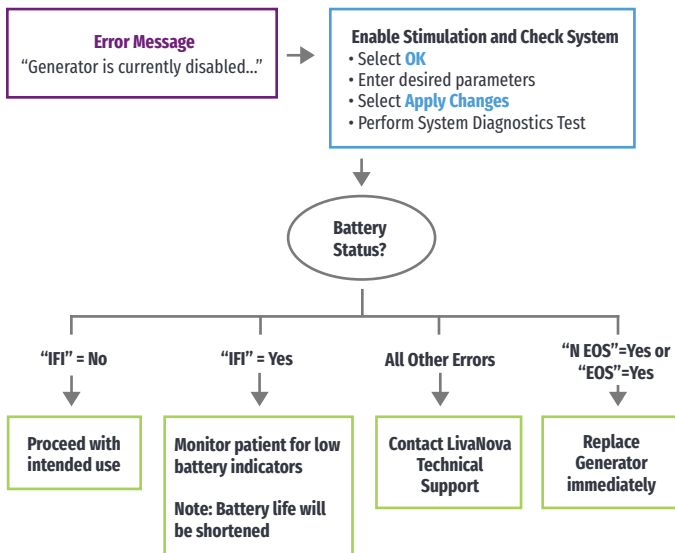
- Electrosurgical equipment used near the generator
- Generator exposed to electrostatic discharge (ESD)



NEW GENERATOR DISABLED DUE TO EOS AT FIRST OFFICE VISIT

Generator model 1000 battery can temporarily drain and become disabled if exposed to certain conditions. These conditions include the following:

- Electrosurgical equipment used near the generator
- Generator exposed to electrostatic discharge (ESD)



SUDDEN DECREASE IN REMAINING BATTERY POWER

If the remaining generator battery power suddenly decreases at an office visit, the following are possible causes:

- First visit after VNS or other surgery: exposure to specific conditions in the OR (see Low Battery/ End of Service Indications in OR) during surgery. If this condition occurred and was not detected in the OR, it is possible you may detect this at the follow up visit. Device will still function normally, but will have decreased battery life. Monitor the patient closely for any low battery indicators.
- Significant change in the lead impedance or increase in programmed stimulation parameters can also result in a change in the estimated battery power remaining. Evaluate battery power remaining between consecutive patient visits before adjusting stimulation parameters.
- Review lead impedance for any significant changes.

If any device issue is suspected, contact LivaNova Technical Support.

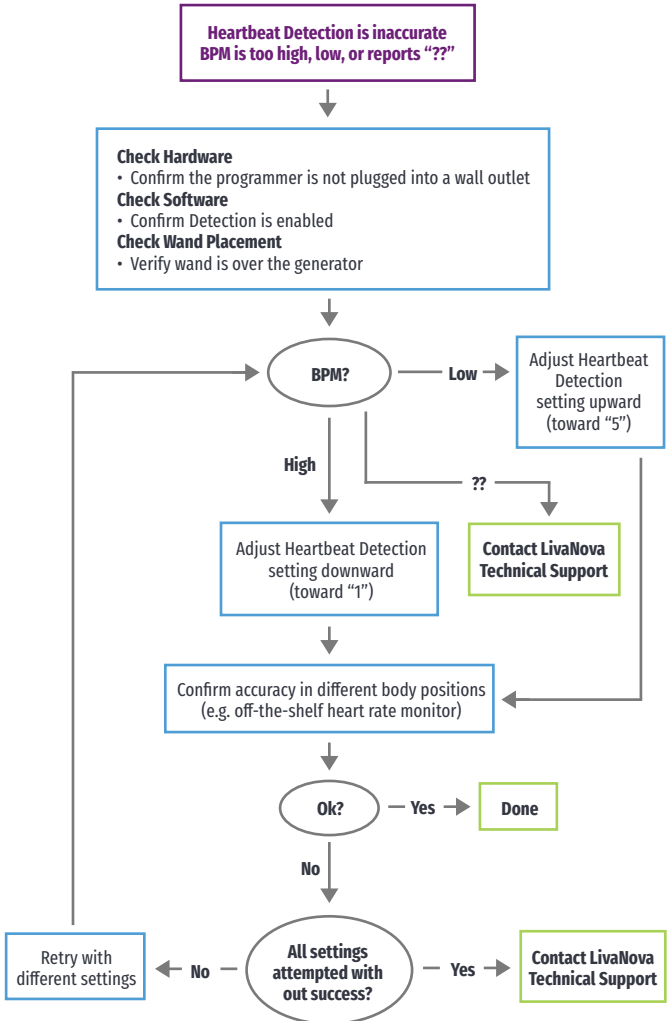
Heartbeat Detection Issues

HEARTBEAT DETECTION INACCURATE (OVER/UNDER) IN OR OR AT FOLLOW-UP VISIT

The heartbeat detection setting may need to be adjusted to accurately detect heartbeats.

NOTE:

The Wand must be held over the generator during the entire Verify Heartbeat Detection process.



Tachycardia Detection Issues

INACCURATE AUTOSTIMS AT FOLLOW-UP VISIT

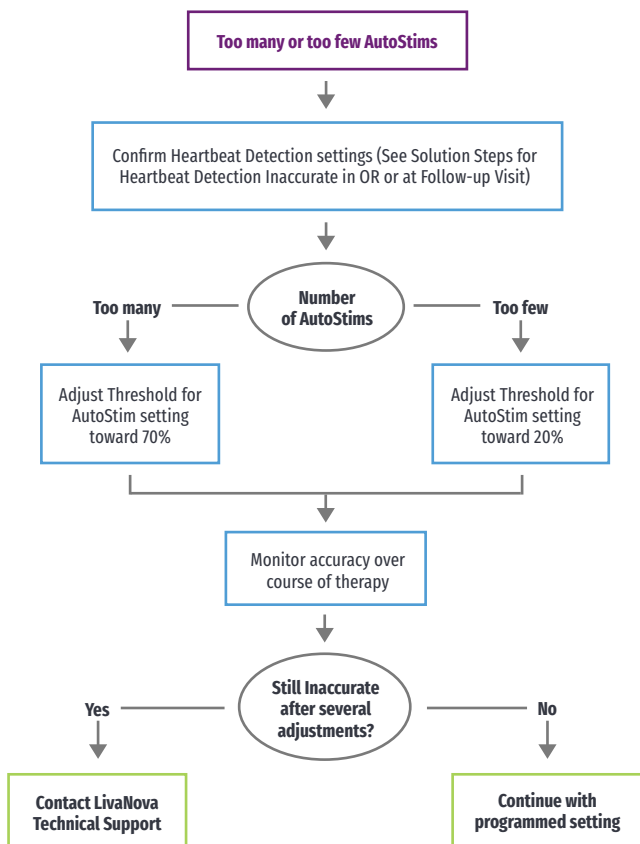
Sometimes generator detection settings may miss detecting heart rate changes that may be associated with a seizure. The following conditions may be potential causes:

Duty cycle

Because the generator can only detect events during OFF time, the OFF time affects accuracy. Shorter OFF time means less chance for the generator to detect events. Longer OFF time, on the other hand, means more chance for the generator to detect events.

Heart rate changes

Exercise, physical activity, and normal sleep can increase the heart rate and cause the generator to falsely declare an event.





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SenTecGd19U1 rev B



LivaNova
Epilepsy



Brief Summary¹ of Safety Information for the VNS Therapy[®] System [Epilepsy Indication] (February 2021)

1. INTENDED USE / INDICATIONS

Epilepsy (US)—The VNS Therapy System is indicated for use as an adjunctive therapy in reducing the frequency of seizures in patients 4 years of age and older with partial onset seizures that are refractory to antiepileptic medications.

2. CONTRAINDICATIONS

Vagotomy—The VNS Therapy System cannot be used in patients after a bilateral or left cervical vagotomy.

Diathermy—Do not use short-wave diathermy, microwave diathermy, or therapeutic ultrasound diathermy on patients implanted with a VNS Therapy System. Diagnostic ultrasound is not included in this contraindication.

3. WARNINGS — GENERAL

Physicians should inform patients about all potential risks and adverse events discussed in the physician's manuals. This document is not intended to serve as a substitute for the complete physician's manuals. The safety and efficacy of the VNS Therapy System have not been established for uses outside the "Intended Use/Indications" section of the physician's manuals. The safety and effectiveness of the VNS Therapy System in patients with predisposed dysfunction of cardiac conduction systems (re-entry pathway) have not been established. Post-implant electrocardiograms and Holter monitoring are recommended if clinically indicated. Postoperative bradycardia can occur among patients with certain underlying cardiac arrhythmias. It is important to follow recommended implantation procedures and intraoperative product testing described in the Implantation Procedure chapter of the physician's manuals. During the intraoperative System Diagnostics (Lead Test), infrequent incidents of bradycardia and/or asystole have occurred. If asystole, severe bradycardia (heart rate < 40 bpm), or a clinically significant change in heart rate is encountered during a System Diagnostics (Lead Test) or during initiation of stimulation, physicians should be prepared to follow guidelines consistent with Advanced Cardiac Life Support (ACLS). Difficulty swallowing (dysphagia) may occur with active stimulation, and aspiration may result from the increased swallowing difficulties. Patients with pre-existing swallowing difficulties and those with a history of drooling or hypersalivation are at greater risk for aspiration. Use of the magnet to temporarily stop stimulation while eating may mitigate the risk of aspiration. Dyspnea (shortness of breath) may occur with active VNS Therapy. Any patient with underlying pulmonary disease or insufficiency such as chronic obstructive pulmonary disease or asthma may be at increased risk for dyspnea. Patients with obstructive sleep apnea (OSA) may have an increase in apneic events during stimulation. Lowering stimulus frequency or prolonging "OFF" time may prevent exacerbation of OSA. Vagus nerve stimulation may also cause new onset sleep apnea in patients who have not previously been diagnosed with this disorder. Device malfunction could cause painful stimulation or direct current stimulation. Either event could cause nerve damage. Patients should be instructed to use the magnet to stop stimulation if they suspect a malfunction, and then to contact their physician immediately for further evaluation. Patients with the VNS Therapy System, or any part of the VNS Therapy System, implanted should have MRI procedures performed only as described in the MRI with the VNS Therapy System instructions for use. In some cases, surgery will be required to remove the VNS Therapy System if a scan using a transmit RF body coil is needed. Excessive stimulation at an excess duty cycle (that is, one that occurs when "ON" time is greater than "OFF" time) and high frequency stimulation (i.e., stimulation at ≥ 50 Hz) has resulted in degenerative nerve damage in laboratory animals. Patients who manipulate the generator and lead through the skin (Twiddler's Syndrome) may damage or disconnect the lead from the generator and/or possibly cause damage to the vagus nerve. The Wand, Programmer, and patient magnet are MR unsafe devices. These devices are projectile hazards and must not be brought into the MR scanner room.

Generators with AutoStim only—The AutoStim Mode feature should not be used in patients with clinically meaningful arrhythmias currently being managed by devices or treatments that interfere with normal intrinsic heart rate responses (e.g., pacemaker dependency, implantable defibrillator, beta adrenergic blocker medications). Patients also should not have a history of chronotropic incompetence [commonly seen in patients with sustained bradycardia (heart rate < 50 bpm)].

Generators with AutoStim only—For anticipated use of the AutoStim feature, it is important to follow the recommended pre-surgical surface assessment described in the Implantation Procedure to determine a location for the generator to reside in which it can accurately detect heart beats.

4. WARNINGS — EPILEPSY

The VNS Therapy System should only be prescribed and monitored by physicians who have specific training and expertise in the management of seizures and the use of this device. It should only be implanted by physicians who are trained in surgery of the carotid sheath and have received specific training in the implantation of this device. The VNS Therapy System is not curative. Physicians should warn patients that the VNS Therapy System is not a cure for epilepsy and that since seizures may occur unexpectedly, patients should consult with a physician before engaging in unsupervised activities, such as driving, swimming, and bathing, and in strenuous

sports that could harm them or others. Sudden unexpected death in epilepsy (SUDEP): Through August 1996, 10 sudden and unexpected deaths (definite, probable, and possible) were recorded among the 1,000 patients implanted and treated with the VNS Therapy device. During this period, these patients had accumulated 2,017 patient-years of exposure. Some of these deaths could represent seizure-related deaths in which the seizure was not observed, at night, for example. This number represents an incidence of 5.0 definite, probable, and possible SUDEP deaths per 1,000 patient-years. Although this rate exceeds that expected in a healthy (nonepileptic) population matched for age and sex, it is within the range of estimates for epilepsy patients not receiving vagus nerve stimulation, ranging from 1.3 SUDEP deaths for the general population of patients with epilepsy, to 3.5 (for definite and probable) for a recently studied antiepileptic drug (AED) clinical trial population similar to the VNS Therapy System clinical cohort, to 9.3 for patients with medically intractable epilepsy who were epilepsy surgery candidates.

5. PRECAUTIONS — GENERAL

Physicians should inform patients about all potential risks and adverse events discussed in the VNS Therapy physician's manuals. Prescribing physicians should be experienced in the diagnosis and treatment of epilepsy and should be familiar with the programming and use of the VNS Therapy System. Physicians who implant the VNS Therapy System should be experienced performing surgery in the carotid sheath and should be trained in the surgical technique relating to implantation of the VNS Therapy System. The safety and effectiveness of the VNS Therapy System have not been established for use during pregnancy. VNS should be used during pregnancy only if clearly needed. The VNS Therapy System is indicated for use only in stimulating the left vagus nerve in the neck area inside the carotid sheath. The VNS Therapy System is indicated for use only in stimulating the **left vagus nerve below where the superior and inferior cervical cardiac branches separate from the vagus nerve**. It is important to follow infection control procedures. Infections related to any implanted device are difficult to treat and may require that the device be explanted. The patient should be given antibiotics preoperatively. The surgeon should ensure that all instruments are sterile prior to the procedure. Children 4-11 years of age may have a greater risk for infection when compared to adolescent and adult patients (≥ 12 years). Careful monitoring for site infection as well as the avoidance of manipulation of the surgical site post implant in children should be stressed. The VNS Therapy System may affect the operation of other implanted devices, such as cardiac pacemakers and implanted defibrillators. Possible effects include sensing problems and inappropriate device responses. If the patient requires concurrent implantable pacemaker, defibrillatory therapy or other types of stimulators, careful programming of each system may be necessary to optimize the patient's benefit from each device. Reversal of lead polarity has been associated with an increased chance of bradycardia in animal studies. It is important that the electrodes are attached to the left vagus nerve in the correct orientation. It is also important to make sure that leads with dual connector pins are correctly inserted (white marker band to + connection) into the generator's lead receptacles. The patient can use a neck brace for the first week to help ensure proper lead stabilization. Do not program the VNS Therapy System to an "ON" or periodic stimulation treatment for at least 14 days after the initial or replacement implantation. For Models 100, 101, 102 and 102R do not use frequencies of 5 Hz or below for long-term stimulation. Resetting the generator disables or turns the device OFF (output current = 0 mA). For Model 100, 101, 102 and 102R, resetting the generator will result in device history loss. Patients who smoke may have an increased risk of laryngeal irritation.

Generators with AutoStim only—Because the device senses changes in heart rate, false positive detection may cause unintended stimulation. Examples of instances where the heart rate may increase include exercise, physical activity, and normal autonomic changes in heart rate, both awake and asleep, etc. Adjustments to the AutoStim feature's detection threshold should be considered; which may include turning the feature OFF.

Generators with AutoStim only—The physical location of the device critically affects the feature's ability to properly sense heart beats. Care must be taken to follow the implant location selection process outlined in the Implantation Procedure.

Generators with AutoStim only—Talk to your patient about use of the AutoStim feature since use of the feature will result in faster battery drain and the potential for more frequent device replacements. The physician's manual describes the impacts to the battery life. The patient should return to their physician at appropriate intervals to further evaluate whether they are receiving benefit from the current AutoStim settings.

M1000 only — Since the Scheduled Programming feature allows the generator to apply therapy increases at scheduled intervals, it may not be appropriate for use in patients who are nonverbal or are unable to use the patient magnet to stop undesired stimulation. Similarly, exercise caution for use of this feature in patients with a history of obstructive sleep apnea, shortness of breath, coughing, swallowing difficulties, or aspiration.

6. ENVIRONMENTAL AND MEDICAL THERAPY HAZARDS

Patients should exercise reasonable caution in avoiding devices that generate a strong electric or magnetic field. If a generator ceases operation while in the presence of electromagnetic interference (EMI), moving away from the source may allow it to return to its normal mode of operation. VNS Therapy System operation should always be checked by performing device diagnostics after any of the procedures mentioned in the physician's manuals. For clear imaging, patients may need to be specially positioned for mammography procedures,

because of the location of the generator in the chest. Therapeutic radiation may damage the generator's circuitry, although no testing has been done to date and no definite information on radiation effects is available. Sources of such radiation include therapeutic radiation, cobalt machines, and linear accelerators. The radiation effect is cumulative, with the total dosage determining the extent of damage. The effects of exposure to such radiation can range from a temporary disturbance to permanent damage, and may not be detectable immediately. External defibrillation may damage the generator. Use of electrocautery or radio frequency (RF) ablation devices may damage the generator. Magnetic resonance imaging (MRI) should not be performed using a transmit RF body coil for certain VNS therapy device configurations or under certain specific conditions. In some cases, heating of the lead caused by the transmit RF body coil during MRI may result in serious injury. Static, gradient, and radio frequency (RF) electromagnetic fields associated with MRI may change the generator settings (i.e., reset parameters) or activate the VNS device if the Magnet Mode output remains "ON". Note that certain magnetic resonance (MR) system head coils operate in receive-only mode and require use of the transmit RF body coil. Other MR systems use a transmit/receive RF head coil. Local or surface coils may also be receive-only RF coils that require the transmit RF body coil for MRI. **The use of a receive RF coil does not alter hazards of the transmit RF body coil.** Exposure of the VNS Therapy System to any transmit RF coil must be avoided. Do not perform MRI scans using any transmit RF coil in the defined exclusion zones. See MRI with the VNS Therapy System instructions for use for details or further instructions for special cases such as lead breaks or partially explanted VNS Therapy systems. Extracorporeal shockwave lithotripsy may damage the generator. If therapeutic ultrasound therapy is required, avoid positioning the area of the body where the generator is implanted in the water bath or in any other position that would expose it to ultrasound therapy. If that positioning cannot be avoided, program the generator output to 0 mA for the treatment, and then after therapy, reprogram the generator to the original parameters. If the patient receives medical treatment for which electric current is passed through the body (such as from a TENS unit), either the generator should be set to 0 mA or function of the generator should be monitored during initial stages of treatment. Routine therapeutic ultrasound could damage the generator and may be inadvertently concentrated by the device, causing harm to the patient. For complete information related to home occupational environments, cellular phones, other environmental hazards, other devices, and ECG monitors, refer to the physician's manuals.

7. ADVERSE EVENTS — EPILEPSY

Adverse events reported during clinical studies as statistically significant are listed below in alphabetical order: ataxia (loss of the ability to coordinate muscular movement); dyspepsia (indigestion); dyspnea (difficulty breathing, shortness of breath); hypoesthesia (impaired sense of touch); increased coughing; infection; insomnia (inability to sleep); laryngismus (throat, larynx spasms); nausea; pain; paresthesia (prickling of the skin); pharyngitis (inflammation of the pharynx, throat); voice alteration (hoarseness); vomiting.

¹ The information contained in this Brief Summary for Physicians represents partial excerpts of important prescribing information taken from the physician's manuals. (Copies of VNS Therapy physician's and patient's manuals are posted at www.livanova.com.) The information is not intended to serve as a substitute for a complete and thorough understanding of the material presented in all of the physician's manuals for the VNS Therapy System and its component parts nor does this information represent full disclosure of all pertinent information concerning the use of this product, potential safety complications, or efficacy outcomes.

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