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# PERMANENT PACEMAKER (PPM)



**SOUTHLAKE**  
REGIONAL HEALTH CENTRE

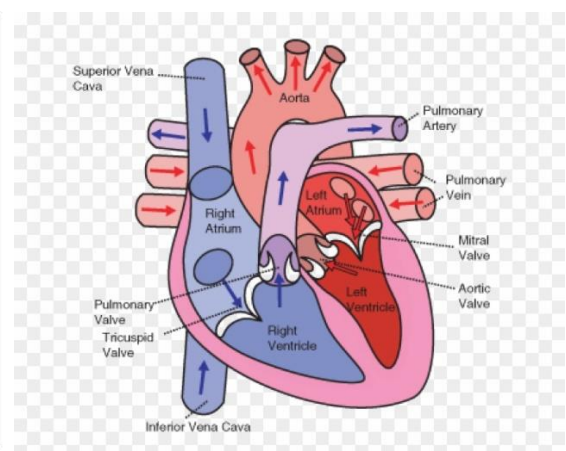
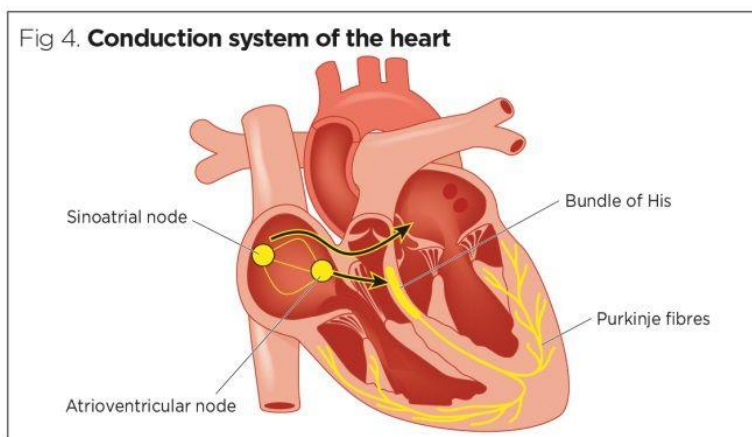
# How does the Heart Work?

Your heart works as both a mechanical pump and an electrical organ. It can beat because it produces electrical signals. These signals travel through the electrical pathways of your heart (Figure 1), causing the muscle contraction that pumps blood throughout your body.

Normally these signals come from a small area in your heart called the sinoatrial (SA) node. This area is in the upper right chamber or right atrium.

When the SA node signals reach the two upper chambers of the heart (the atria), they contract at the same time. The atrial contraction fills the two lower chambers (the ventricles) with blood.

As the electrical signal travels through the ventricles, it causes them to contract, which pumps blood out to your body. The contraction of the heart muscle (ventricles) is what you feel as a heartbeat. After a brief rest, the cycle begins again.

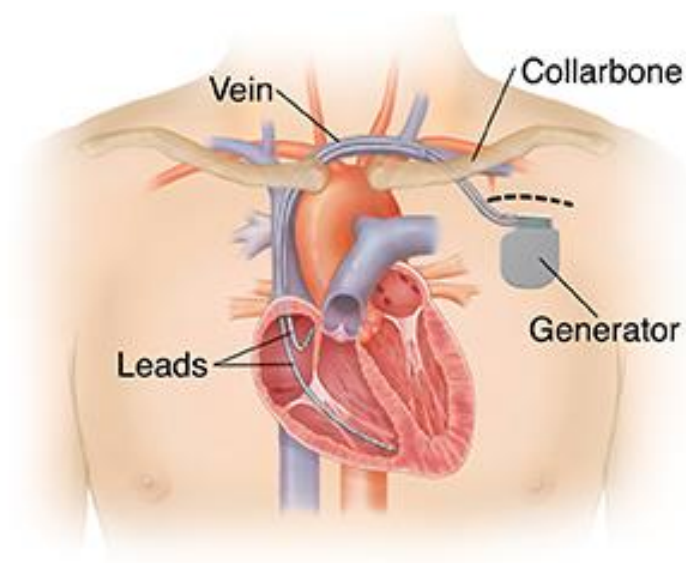


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## What is a Pacemaker?

The pacemaker (PPM) is a device that monitors your heart rhythm. If the PPM detects that your heart is going too slow, it will deliver electrical energy to pace your heart so it will not go below a certain rate. Pacemakers do not control heart rates that are too fast.

Medications or other therapies (like ablation) may be used to control the fast heart rates. You will usually not feel anything when your PPM is working.



The PPM system consists of a pulse generator connected to wires (leads) that sense and pace your heart rhythm. The pulse generator and the leads are surgically implanted. There is also a programmer that is used to communicate with your PPM.

### **a) The Pulse Generator:**

The pulse generator is about the size of two “toonies” and is about 1 cm thick. It is powered by a battery and monitors the electrical signals in your heart. When a slow heart rate is detected in your heart, the pulse generator will pace your heart. The device can also store information about your heart rates and arrhythmias.

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## **b) The Lead System:**

The leads are wires threaded into veins under your collarbone and implanted into your heart that detect your heart rhythm. The tip of the lead(s) has a sensor that "sees" your heart rhythm all the time and this information is then sent to the computer in the generator. As well, any electrical energy that the pulse generator sends to the heart travels along the leads.

## **c) The Programmers:**

The programmer is a laptop computer-like device that communicates with your PPM in the same fashion that a remote control communicates with a television set. Using the programmer, the functions and settings of your PPM are programmed and tested after implant. Also, when you visit the PPM clinic, the programmer is used to retrieve information about your heart rhythms, stored in the pulse generator. Every time you have what your PPM considers to be an abnormal rhythm, the PPM stores the:

1. Date and time it occurred
2. An ECG (electrocardiogram) taken before, during and after the rhythm
3. Measurements that were taken during the episode

This information helps the Clinic staff to determine if all your settings (and medications) are correct.

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# What are the Types of Pacemakers?

There are two different types of pacemakers: single-chamber and dual-chamber. Both pacemakers continuously monitor your heart rate and send out pacing signals when necessary. It is important to discuss with your doctor what kind of pacemaker is right for you.

## Single-chamber pacemakers

A single-chamber pacemaker has one lead to monitor signals from and deliver pacing pulses to one chamber of your heart (either the right atrium or right ventricle). This type of pacemaker is often selected for a person whose SA node sends out signals too slowly or for people with a condition called “atrial fibrillation” where their atrium no longer sends out normal electrical signals.

## Dual-chamber pacemakers

A dual-chamber pacemaker has two leads. One lead is placed in the right atrium, and the other lead is placed in the right ventricle. Because there are leads in two chambers, the pacemaker can monitor signals from and deliver pacing impulses to either or both heart chambers.

A dual-chamber pacemaker may be selected for many different reasons. For some people, the SA node's signals are too slow and the electrical pathway to the ventricles is partly or completely blocked. A dual-chamber pacemaker can help treat both problems. For other people, the timing of the atrial and ventricular contractions is uncoordinated (asynchronous). A dual-chamber pacemaker can restore a normal timing sequence (also called AV synchrony).

## Rate-responsive pacing

All PPMs today have this feature. Your normal heart rhythm slows down or speeds up many times during the day. The heart beats slower while resting or sleeping; it beats faster in response to exercise and excitement.

Your heart rate changes to supply the blood your body needs during your changing levels of activity.

Rate-responsive pacing is needed when your heart cannot adjust its rate to meet the needs of your body. This type of pacing varies its rate depending on your level of activity, respiration, or other factors. Rate-responsive pacing can be part of a single-chamber or dual-chamber pacing.

When your heart cannot adjust its rate, a rate-responsive pacemaker uses one or more special sensors. These sensors monitor changes in your body.

The pacemaker uses this information to increase or decrease your heart rate. Variations in the pacing rate allow you to perform your everyday activities with ease. If you are walking, exercising, or gardening, the pacemaker automatically adjusts your heart rate to match your level of activity. When you slow down, rest, or sleep, the rate decreases. The way your heart rate changes is based on the values (programmed settings) chosen by your doctor.



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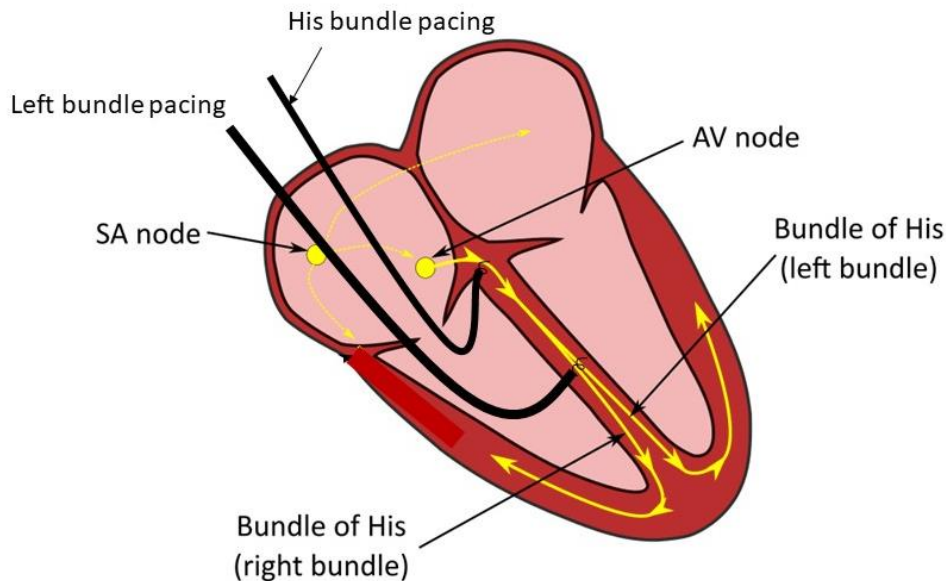
## Physiologic Pacing – HIS bundle or LEFT bundle pacing

Traditionally, we have implanted the lead for the lower chamber (ventricle) in the bottom or the side of the ventricle – wherever is easiest – because the lead will work in either position.

More recently, we have appreciated that by screwing the lead into the heart’s natural wiring, we can take advantage of the heart’s electrical system and provide you with more “natural” pacing. It is believed that this may offer benefits in the long-term.

Although the technique seems safe and effective, there is still only limited long term data. The wire must also be screwed deeper into the heart tissue. There does not seem to be any negative effects from this, but again, we have only limited data.

This is becoming a more popular form of delivering pacing. Not everyone will benefit from this type of pacing and the decision will be made by your doctor.



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# Implanting the PPM

Usually, the pulse generator is implanted in the upper chest area on the left side, but it may also be implanted in the right upper chest.

A PPM implantation is generally considered relatively minor surgery and the operation itself usually takes about an hour.

It is performed as day surgery, meaning you arrive for the surgery and leave after the surgery on the same day. You can expect to spend a few hours at the hospital on the day of surgery.

The risks of the procedure include bleeding, infection, damaging the lung or heart which would require a drain, or the leads coming out of position after surgery (“dislodgement”) which would require another procedure. These complications are typically 1% or less.

## **PRE-OPERATIVE INSTRUCTIONS**

These are general guidelines for you to follow before you have your PPM implanted or a replacement procedure. Be sure to follow any specific instructions from your physician and the PPM Clinic.

### **Some general instructions will include:**

Do not eat or drink anything the night before your surgery (this includes gum, candy, and water).

Medication is usually taken as prescribed in the morning of your surgery with sips of water.

Blood thinners may be stopped one or two doses in advance of the surgery. Check with the PPM Clinic or your physician beforehand for clarification.

You will usually be given antibiotics just before the procedure. Be sure you notify the PPM Clinic if you have any allergies to medications like penicillin.

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## **POST-OPERATIVE INSTRUCTIONS**

A nurse will give you post-operative instructions after your surgery. You must follow these post-operative instructions in addition to other instructions from the PPM clinic or your physician. These precautions are necessary for a healthy recovery from surgery.

### **WOUND CARE**

Your incision will usually be closed with dissolvable stitches. If not, the stitches will need to be removed in 7 - 10 days by your family doctor or PPM clinic nurse our first follow-up appointment. Invisible stitches will dissolve on their own and will not need removal.

If you notice any signs of redness, swelling, localized pain, or oozing from the incision or opening of the incision, **YOU MUST REPORT IT TO US IMMEDIATELY**. If you are unsure, call us anyway.

Try not to get the wound wet for the first 4 days. You may take a shower after the first 4 days. For the first 4 days, we recommend taking a sponge bath and avoiding wetting the wound.

Keep the wound covered (fresh dressing daily) for about 4 days, then leave it open to the air.

**Do not allow a doctor or nurse to place a needle into your device pocket at any time, even if it appears infected.**

### **EXERCISE AND ACTIVITY**

Do not raise the arm on the side with the incision above the level of your shoulder for approximately 1 month. Remember that activities like brushing your hair, or reaching for a high cabinet, or golfing can all stretch that arm.

**Do not lift heavy objects (more than 5-10 pounds) with your affected arm for 6 weeks.**

But you must continue to move that arm a little. If you do not, the shoulder will give you problems that may require up to 6 months of physiotherapy.

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We suggest the following shoulder exercise: hold your arms outstretched at your sides and make small circles in the air. Do this exercise for 10 - 15 rotations, 4 times per day.

### **PAIN MANAGEMENT**

You should 'be able to manage the pain with either plain Tylenol or Extra Strength Tylenol for a few days. If you find that your pain is still unmanageable, please call us.

### **RESUMING ACTIVITIES AND RETURNING TO WORK**

You and your physician will decide when you may resume your regular activities and return to work. If you have been hospitalized for some time, try to increase your activity slowly.

Usually, you can return to light work within a few days. But heavier work may require 2-4 weeks off work.

### **MEDIC ALERT BRACELET**

A Medic Alert bracelet/necklace identification should always be worn. Should you fall unconscious, the Medic Alert identification will let people know that you have a PPM and also give information about any other health problems you have.

You should receive a Medic Alert application before leaving the hospital at the time of your implant. If you already have a Medic Alert, you must contact them so the information in their files can be updated.



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## PPM IDENTIFICATION CARD

You will be given a temporary PPM identification card on the day of your surgery. You should receive your permanent card within 4-8 weeks after the operation.

**You should always carry your PPM Identification card.** The card contains important information about your device and will need to be seen at some medical appointments, by airport security officers, and in case of a medical emergency.

The diagram shows a 'Medical Device ID' card. The card has a blue header with the text 'Medical Device ID'. Below the header, there is a section for patient and physician information: 'Patient: Your Name Here', 'Physician: Your Doctor, MD', and 'Physician Telephone: 555-555-5555'. Below this is a table with four columns: 'MFG', 'Product', 'Model/Serial', and 'Implant Dt'. The first two columns are circled in red, and a red line points from the word 'Product' above to the 'Product' column. A red line also points from the text 'Model & Serial Number' to the 'Model/Serial' column. The table contains two rows of data: 'Co. X ICD T135 12345 04-MAY-2004' and 'Co. Y Lead SP01 02-OCT-2000'.

MFG	Product	Model/Serial	Implant Dt
Co. X	ICD	T135 12345	04-MAY-2004
Co. Y	Lead	SP01	02-OCT-2000

## DIARY AND MEDICATION LIST

Please keep a diary with the following information and bring it to all your PPM clinic visits:

1. Your current medications including the dosage (the amount)
2. Doctor appointments and tests performed
3. Any changes in the appearance of your device. Include the time and date and what you were doing.

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## How do I Follow-up with my PPM?

You will follow-up in the PPM clinic. Your first clinic appointment will be approximately 2-4 weeks after your PPM device is implanted. We will check if the device and leads are operating properly and check your wound.

Follow-ups after that will be at 6 months and then every 6-12 months after that unless there is a problem. Some of your follow-ups may be in person, but others may be done by remote monitoring (see image and description later).

What to bring to each clinic visit:

1. Ontario Health Card
2. A current and complete list of all your medications (including the dosages), or all your pills in their original containers
3. Your diary (see earlier)

At the clinics, the information stored in your PPM will be read through the programmer by placing a wand over the device.

Your device and leads will also be checked to ensure that they are functioning properly, and the battery voltage is good. Your wound will be examined and any symptoms you are having will be discussed.

Feel free to ask us any questions at that time.

Please note that the clinic is not meant to replace the care you receive from your family doctor and your cardiologist in your community. A letter will be sent to your doctor after each clinic visit.

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# What is Remote Monitoring?

**Pacemakers may not be programmed to receive or transmit remote programming.**

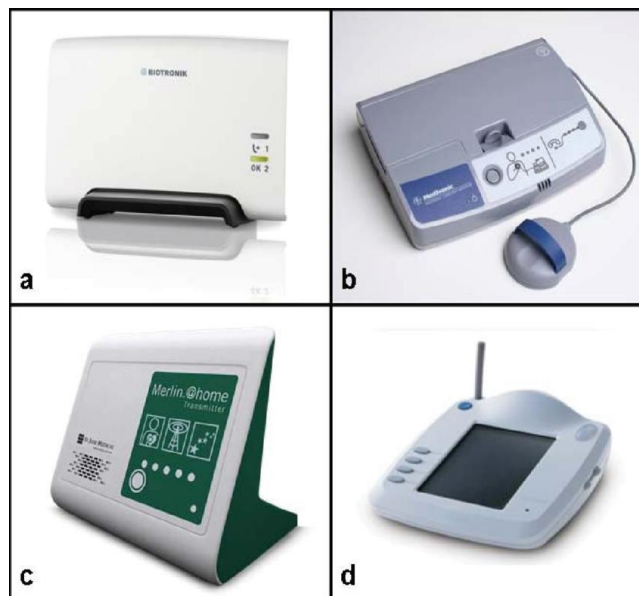
A remote monitor is a portable device that you either take home or it is delivered to you. It usually sits at your bedside and allows you to send information stored in your device to your clinic. It may be connected to a telephone landline or a cellular or Wifi Accessory.

Your PPM device information is then transmitted to a secure Internet website where your clinic can access and review information about how your heart and device are working.

The remote monitor provides the same device information to your doctor that an in-clinic office visit provides. Information in your device may also be sent automatically, using wireless communication. This process is silent and usually happens at night while you're asleep.

Automatic, wireless monitoring can also notify your clinic of irregular heart activity or conditions with your device, such as a low battery. Your clinic may program your device to send such notifications to help manage your care.

**Remember, remote monitoring is not meant to be an emergency service and will only be read during regular clinic hours.**



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## How long will the battery last? Does it need to be replaced?

On average, your device's battery will last 5-10 years. The average is about 7-9 years. It depends on how much the device is used. When we interrogate your device, we will find out how much battery is remaining. We always replace the battery when there is still more than 3 months of battery life remaining.



When your battery needs replacing, we replace the entire generator (see above). The wires will remain in place and will not be routinely changed.

For the battery replacement procedure, you will come in for a day surgery, just like your original implant. However, battery replacement usually takes less time.

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# Living with your PPM

The idea of having a PPM is so that you can live your life as normally as possible.

But you should be aware of some practical items you will encounter in everyday life.

## a) Other Surgery

Before you undergo any surgical procedure, you must contact the PPM clinic since reprogramming may be necessary. Certain equipment may interfere with the functioning of your PPM device. If you are unsure about any other treatment you may undergo, don't hesitate to call us to discuss your concerns.

## b) Travel

Your PPM will not prevent you from traveling to most countries in the world. If you need emergency care, just go to the nearest hospital and show them your PPM wallet ID card and they will be able to contact someone to come and read your defibrillator.

Remember to show your PPM identification card to airport security to avoid being searched with a handheld wand. Please request a manual search. Plan to add an extra 5 - 10 minutes to your pre-boarding time to get through security.

## c) Dental Work

You should let your dentist know that you have an implanted device before any dental work. Your dentist may prescribe antibiotics before dental work to prevent any infection from getting into the bloodstream.



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## What is electromagnetic interference (EMI)?

Your PPM device is sensitive to strong electrical and magnetic fields/currents. Strong electrical and magnetic currents will interfere with the proper functioning of your PPM. This is called “electromagnetic interference” or EMI.

General household appliances are safe to use, provided they are properly grounded, and are in good condition. Examples of appliances and other household objects that will not interfere with your device include microwaves, cordless phones, TV/DVD players, TV remotes, AM/FM radios, computers, photocopiers, fax machines, Wifi internet, toasters, hairdryers, electric razors and toothbrushes, sewing machines, heating pads, lawnmowers, and leaf-blowers.

**Cellular phones** rarely interfere with your PPM. You are in no danger if others near you using cell phones or if you use a cell phone and hold it to your ear. Cell phone antennae should be kept at least 6 inches (15 cm) away from your PPM device. Do not put the cell phone in the breast pocket of your shirt or jacket on the side where your PPM is implanted. If your PPM is in your abdomen, do not clip the phone to your belt near the device. When using a cell phone, place the phone on the ear that is opposite to the side where your device is implanted. In other words, if your PPM device is on the left side of your chest or abdomen, use the phone on the right side of your head.



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# When should you worry about EMI?

Before undergoing any of the following procedures, please contact the PPM clinic:

**Diathermy** - This test employs electrical currents to body tissue. The electrical fields could potentially interfere with device functioning.

**Electrocautery** - This is a medical instrument used during surgery to stop bleeding. Electrocautery should only be used if your device is turned off.

**Lithotripsy** - This is the procedure by which stones (e.g. kidney stones) are broken up. Your device may require re-programming.

**Radiation therapy** – Radiation is sometimes used in the treatment of cancer. If the radiation will be aimed directly over the device, it could disrupt the device. Radiation aimed away from the device is usually acceptable. The device may require re-programming.

The following items may be used, but **you should exercise caution**:

**Car engine repair**: use caution when near the coil, distributor, or spark plug cables of a running engine. Turn off the engine before making any adjustments to the distributor. DO NOT LEAN on running electrical engines.

**Large stereo speakers**: do not lift them close to your device.

**Soldering guns, demagnetizers**: 6 inches away from your device. Metal detectors 24 inches.

**CB, Amateur HAM radios**: you should keep a distance between the radio antenna and your device. It depends on the location/power. Portable (1 foot), car (3 feet), home (10 feet).

**Retail and library security systems**: to prevent the effects of these systems on your device, just walk normally through them. Do not linger near or lean against these detectors. It is unlikely that your device will set off retail or library security systems. However, always carry your device ID card.

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## Is there anything I cannot do with my device?

Heavy electrical or industrial equipment often produces EMI. This equipment may affect how your device works. Check with your doctor before working with the following equipment:

Dielectric heaters - used in industry to bend plastics.

Electric arc welding equipment

Electric steel furnaces used in factories

Induction furnaces such as kilns

Industrial magnets

Power plants - large generators, transmission lines, transmission buildings, and turbines

Gas-powered chain saws

## Can I have an MRI?

Most devices implanted today are “compatible” with magnetic resonance imaging (MRI). The device may require some programming before and after your MRI. You should always have your device checked before and after an MRI.

Certain types of MRI protocols or MRI aimed directly at the device may not be allowed by your device manufacturer. Older devices and leads may not ever be “compatible” with MRI.

Some centers will perform an MRI on any type of device (whether compatible or not) but you need to consult with the MRI department doing your test.

If you have abandoned leads, or broken leads, or certain types of adapters, you may not be able to have an MRI at all.

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## Can I drive with my device?

Initially, you may not be allowed to drive a car right after your surgery (usually 7 days). Further restrictions on driving will depend on your condition.

Remember that the PPM does not prevent your rhythm problem. Rhythm problems can still occur and if they do, the device will treat them.

Commercial driving (large trucks, commercial vehicles, large passenger vehicles like buses) may be restricted by your condition whether you have the device or not.

## Where should I contact you?

You can contact us at the PPM clinic:

Southlake Regional Health Centre

Medical Arts Building

Suite 602, 581 Davis Drive

Newmarket, Ontario, L3Y 2P6

Phone: 905-895-4521 ext 2860

