

InterSim III

Temporary Pacemaker Troubleshooting

Discovering failures and solutions using the interactive heart simulator InterSim III

The suggestions were taken from <https://litfl.com/temporary-pacemaker-troubleshooting/>.

Temporary Pacemaker Troubleshooting

Prerequisites

InterSim III Interface version 1.5.8483 or newer

InterSim III Touch version 1.5.8483 (package 023) or newer

InterSim III Temporary Adapter

Medtronic Temporary Pacemaker 5388

Failure to pace due to output failure

Goal:

To show a broken or dislocated lead

Pacemaker settings:

Parameter	Value
Mode	VVI
Rate	80 bpm
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
AV Block	AV Block III	Blocks menu	Select "AV Block III"
Lead condition	Fracture	Interface menu PM parameters	Right Ventricle Impedance, Tip Condition, select "Fracture", press "Apply"

Result:

- Irregular sensing on the ventricular channel
- Some pacing activity on the ventricular channel
- No capture

Solution:

- Check the lead
- Check the location of the lead
- (Reset the fracture lead condition in the InterSim application)

Temporary Pacemaker Troubleshooting

Failure to Capture

Goal:

To show a high pacing threshold

Pacemaker settings:

Parameter	Value
Mode	VVI
Rate	80 bpm
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
AV Block	AV Block III	Blocks menu	Select "AV Block III"
Lead impedance	Bipolar lead impedance of 400Ω (that is the sum of tip and ring impedance)	Interface menu PM parameters	Impedance Right Ventricle, Tip Impedance, change to 250Ω , press "Apply"
Threshold	High threshold of 8V	Interface menu PM parameters	Change right ventricular threshold to 8V, press "Apply"

Result:

- No capture in the ventricle
- A ventricular escape rhythm of 28 bpm can be seen

Solution:

- Set the ventricular output of the temporary pacemaker to at least 16 mA

Hint:

- Lowering the impedance also lowers the voltage of the output pulse and is better suited to the measuring range of the InterSim device

Temporary Pacemaker Troubleshooting

Failure to Sense (Atrium)

Goal:

To show a small intrinsic signal or a low sensitivity in the atrial channel

Pacemaker settings:

Parameter	Value
Mode	AAI
Rate	80 bpm
Atrial sensitivity	1.4 mV
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
Sinus rate	Set a rate above the pacemaker rate, 90 bpm	Home Screen	Parameters group, change "Atr." to 90 bpm
Atrial Amplitude	Small ventricular intrinsic signal	Interface menu PM parameters	Amplitude Atrium, change to 0.9mV, press "Apply"

Result:

- No sensing in the atrium
- The pacemaker paces even though an intrinsic signal is present

Solution:

- Increase the sensitivity of the atrial channel of the pacemaker (reduce the absolute value) until the pacemaker senses the intrinsic signal again; a value of 0.5 mV should work

Temporary Pacemaker Troubleshooting

Failure to Sense (Ventricle)

Goal:

To show a small intrinsic signal or a low sensitivity in the ventricular channel

Pacemaker settings:

Parameter	Value
Mode	VVI
Rate	80 bpm
Ventricular sensitivity	5 mV
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
Sinus rate	Set a rate above the pacemaker rate, 90 bpm	Home Screen	Parameters group, change "Atr." to 90 bpm
Right ventricular Amplitude	Small ventricular intrinsic signal	Interface menu PM parameters	Amplitude Right Ventricle, change to 3mV, press "Apply"

Result:

- No sensing in the ventricle
- The pacemaker paces even though an intrinsic signal is present

Solution:

- Increase the sensitivity of the ventricular channel of the pacemaker (reduce the absolute value) until the pacemaker senses the intrinsic signal again; a value of 3 mV should work

Temporary Pacemaker Troubleshooting

Oversensing in the Atrial Channel

Goal:

To show an unwanted inhibition of the pacemaker

Pacemaker settings:

Parameter	Value
Mode	DDD
Rate	80 bpm
PVARP	150 ms
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
Sinus rate	Set a bradycardic sinus rate	Home Screen	Parameters group, change "Atr." to 50 bpm
AV block	AV block III	Blocks menu	Select "AV Block III"
Far-Field R Wave	Set a late and small far-field R wave	Parameters menu Far-Field R Wave	Select "Small" Set "Paced" interval to 200 ms

Result:

- Oversensing in the atrium
- Asynchronous high rate pacing in the ventricular channel

Solution:

- Decrease the sensitivity of the atrial channel of the pacemaker (increase the absolute value) until the pacemaker doesn't sense the Far-Field signal; a value of 1.0 mV should work or
- Increase the PVARP to the default value of 300 ms

Temporary Pacemaker Troubleshooting

Oversensing in the Ventricular Channel I

Goal:

To show an unwanted inhibition of the pacemaker

Pacemaker settings:

Parameter	Value
Mode	DDD
Rate	80 bpm
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
Noise on the ventricular lead		Interface menu PM parameters	Select the "Noise" radio button in the "EMI Right Ventricle" group

Result:

- Oversensing in the ventricle
- No/irregular pacing in both channels

Solution:

- Decrease the sensitivity of the ventricular channel of the pacemaker (increase the absolute value) until the pacemaker doesn't sense the noise; a value of 5 mV should work

Hint:

- In a later application release, the "Noise" will be replaced by "Myopotential". The signal forms of noise and myopotential are different, but the effects on the pacemaker are comparable.

Temporary Pacemaker Troubleshooting

Oversensing in the Ventricular Channel II

Goal:

To show an oversensing in the ventricular channel

Pacemaker settings:

Parameter	Value
Mode	DDD
Rate	80 bpm
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press "Reset" button
Device Type	Dual Chamber	Home Screen	Select "Dual Chamber" radio button
AV block	Set a 2:1 block	Blocks menu	Select "AV Block II Mobitz II", "2:1"
PR interval	Set PR interval (AV interval) for intrinsic conduction	Home Screen	Parameters group Set "PR" to 130 ms
T Wave Amplitude	Large T wave	Parameters menu T Wave Amplitude menu item	Select "Extralarge"

Result:

- Oversensing in the ventricle
- Every second pace comes with the escape rate of the pacemaker

Solution:

- Decrease the sensitivity of the ventricular channel of the pacemaker (increase the absolute value) until the pacemaker doesn't sense the noise; a value of 3 mV should work

Temporary Pacemaker Troubleshooting

Pacemaker Mediated Tachycardia

Goal:

To show a pacemaker mediated tachycardia

Pacemaker settings:

Parameter	Value
Mode	DDD
Rate	80 bpm
All other parameters	default

InterSim settings:

Parameter	Value	Where to find	What to do
Factory settings	default	Home Screen	Press „Reset“ button
Device Type	Dual Chamber	Home Screen	Select „Dual Chamber“ radio button
RP Interval Premature Contractions Coupling Interval	Set high intervals to enable a pacemaker race	Parameters menu Intervals	Set “RP” interval to 300 ms Set “Premature Contractions Coupling Interval” to 400 ms Press Ok
Retrograde Conduction	Enable retrograde conduction	Blocks menu	Check “Retrograde Conduction”
Start PMT with right premature ventricular contractions		Home Screen Premature Contractions Group	Press left “rPVC” button twice

Result:

- A pacemaker mediated tachycardia with the upper rate of the pacemaker can be seen

Solution:

- Switch the pacemaker mode to DVI

Temporary Pacemaker Troubleshooting

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