

## Noise Rejection Feature in Boston Scientific Pacemakers

### BACKGROUND INFORMATION

All Boston Scientific cardiac rhythm pulse generators incorporate blanking and noise rejection features to prevent ventricular pacing inhibition due to cross-chamber sensing. In Boston Scientific pacemakers, this feature is called “noise rejection,” and in Boston Scientific defibrillators and cardiac resynchronization therapy devices, this feature is called “noise response.”

This article explains the ventricular noise rejection feature in Boston Scientific pacemakers with respect to atrial stimuli that is sensed on the ventricular channel and compares it to Medtronic’s “Ventricular Safety Pacing” feature. In the context of this article, an atrial pacing pulse or other atrial noise sensed as electrical activity in the ventricle constitutes cross-chamber sensing.

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### CRM PRODUCTS REFERENCED

All CRM Pacing Systems

### CRM CONTACT INFORMATION

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### Why is the noise rejection feature needed?

Boston Scientific pacemakers employ a cross-chamber noise rejection feature to prevent inappropriate ventricular pacing inhibition due to cross-chamber sensing. Pacing inhibition can result in an inappropriate decrease in a patient’s paced heart rate.

### How does the cross-chamber noise rejection feature work?

In the ventricle, an atrial pace concurrently starts a programmable ventricular blanking interval (30-200 ms) and a 40 ms noise rejection interval. The beginning of these intervals coincides with the beginning of the AV Delay, which is the programmable period from the beginning of the atrial event to the paced ventricular event. If no intrinsic activity is detected beyond the blanking period, a ventricular paced event occurs when the AV Delay timer expires (Figure 1).

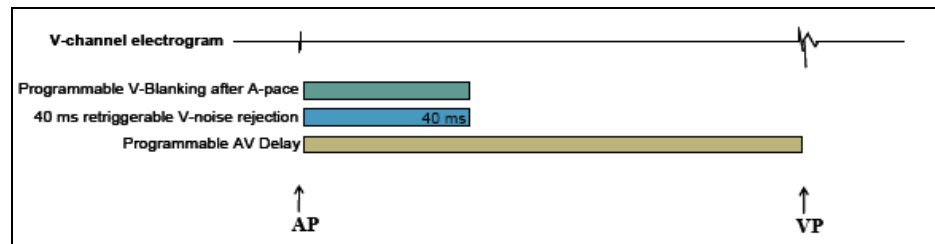


Figure 1. Concurrent initiation of programmable V-Blanking and 40 ms retriggerable V-noise rejection intervals.

Cross-chamber sensing that occurs early in the AV Delay is ignored by the ventricular channel, because it falls within the blanking interval. While Medtronic’s blanking system disables the sense amplifiers completely so that electrical activity cannot be detected at all during blanking<sup>1</sup>, Boston Scientific sense amplifiers can detect electrical activity during the blanking period but do not respond to it, except to extend the noise rejection interval (Figure 2).

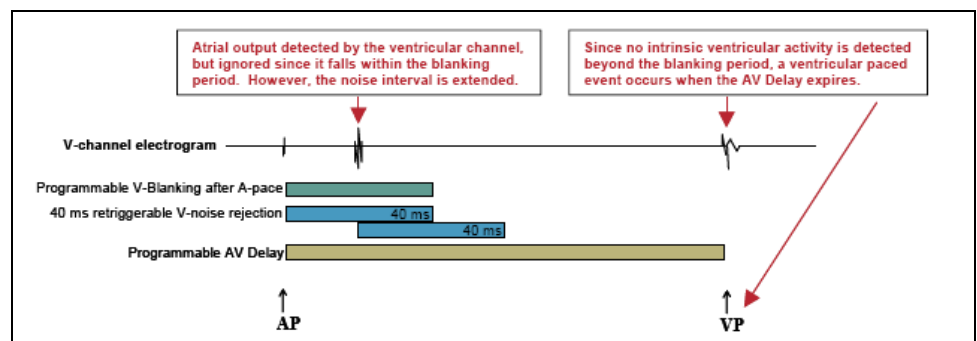
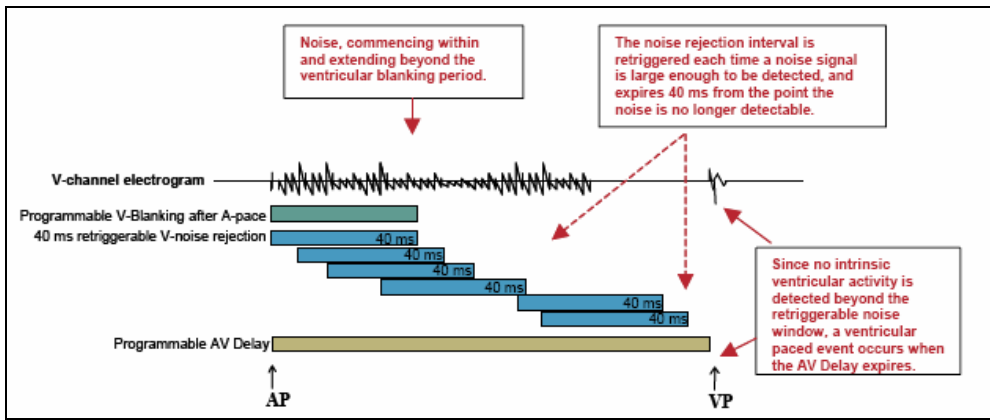


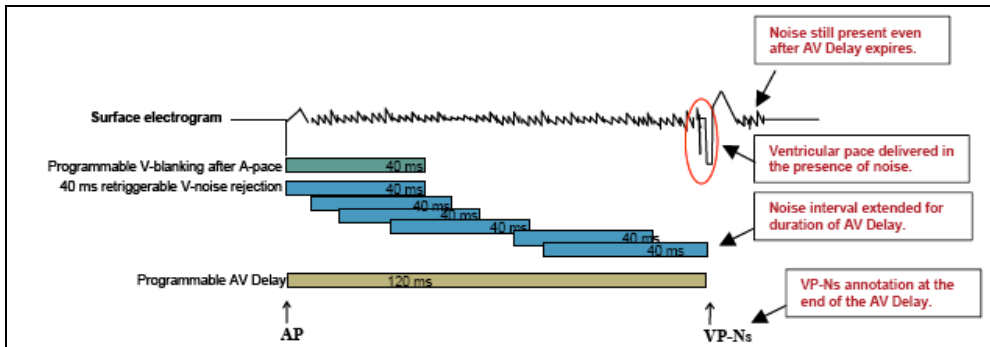
Figure 2. Cross-chamber sensing is ignored during the ventricular blanking interval.

As a supplement to the ventricular blanking period, the 40 ms noise rejection interval is retriggered whenever the ventricle detects noise. It continues to extend in these intervals until the noise is no longer detected, up to the length of the AV Delay. Once the AV Delay timer expires, the device automatically delivers a ventricular pace if no intrinsic activity is detected (Figure 3).



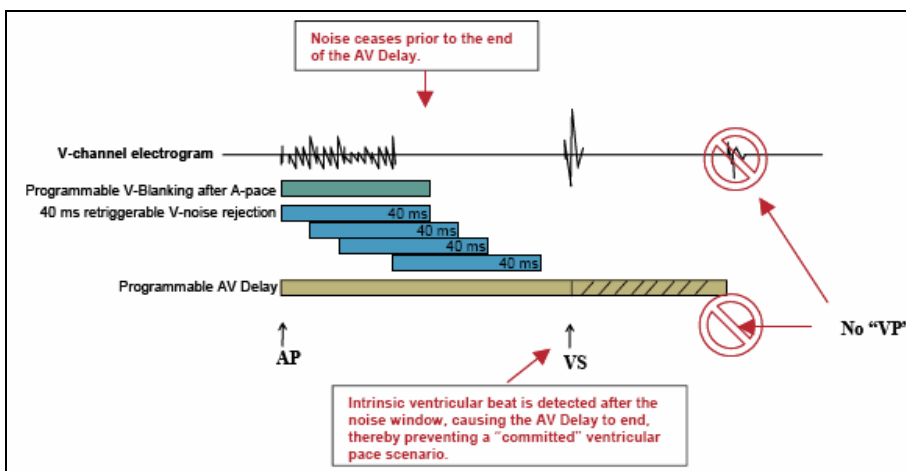
**Figure 3. Extension of 40 ms retriggerable noise rejection interval beyond the ventricular blanking period.**

Even though noise may continue throughout the duration of the AV Delay, Boston Scientific pacemakers deliver a pacing pulse when the AV Delay timer expires, preventing ventricular inhibition due to noise. If a ventricular pacing spike is delivered under conditions of continuous noise, a “VP-Ns” marker notation appears on the surface electrogram (Figure 4 - “VP-Ns” is an abbreviation for “Ventricular Pace-Sense Amp Noise”). Note that this notation only appears when the atrial and ventricular electrograms are turned off.



**Figure 4. Device delivers ventricular pace as programmed even in the presence of noise.**

If noise ceases prior to the expiration of the AV Delay, the device can detect an intrinsic beat that occurs at any time beyond the 40 ms retriggerable noise interval. If intrinsic ventricular activity is detected, the AV Delay timer expires, and a new cardiac cycle is initiated. The device is not committed to pace and does not deliver a ventricular pacing pulse (Figure 5).



**Figure 5. Device detects intrinsic ventricular activity and inhibits ventricular paced beat.**

## **Medtronic's Ventricular Safety Pacing<sup>2</sup>**

Medtronic uses "Ventricular Safety Pacing" to prevent ventricular asystole due to cross-chamber sensing of atrial stimuli. In Medtronic devices, an atrial pace starts a brief programmable ventricular blanking interval. At the conclusion of this brief interval, if atrial-paced noise is detected in the ventricle, this feature automatically paces the ventricle at 110 ms or at the programmed AV Delay, whichever comes first—even in the presence of intrinsic ventricular activity. While Medtronic devices are committed to automatically pace the ventricle in the presence of noise outside of the ventricular blanking interval, Boston Scientific devices are not committed to pace under this same scenario. Rather, our concurrent blanking and retriggerable noise rejection features enable our devices to withhold ventricular pacing in the presence of intrinsic ventricular activity outside of blanking, yet provide pacing therapy if noise continues throughout the AV Delay.

### **Key points to remember:**

1. Boston Scientific pulse generators use programmable ventricular blanking and retriggerable noise rejection intervals to prevent inappropriate ventricular pacing inhibition due to paced atrial events.
2. Boston Scientific's noncommitted design allows appropriate inhibition of ventricular pacing therapy in the presence of intrinsic ventricular activity (unless noise continues throughout the entire AV Delay).
3. If noise is present throughout the entire AV Delay period, Boston Scientific devices pace the ventricle at expiration of the programmed AV Delay.
4. Medtronic's "Ventricular Safety Pacing" is committed to delivering a ventricular pacing pulse if noise is detected beyond the blanking interval.

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<sup>1</sup> Medtronic Kappa 700/600 Series Pacemaker Reference Guide, page 3-26.

<sup>2</sup> Medtronic Kappa 700/600 Series Pacemaker Reference Guide, pages 5-19 and 5-20.