Introduction
Cross-chamber blanking periods are an integral part of the ICD and CRT-D sensing systems. They are used to suppress detection of device-generated artifact (e.g., pace or shock delivery) as well as certain intrinsic signal artifacts (e.g., far-field R-waves).

- Events that occur during refractory and cross-chamber blanking periods are ignored for the purposes of pacing timing cycles and ventricular tachycardia detection.
- Each refractory and fixed cross-chamber blanking period includes a re-triggerable noise window, which helps to detect and classify persistent noise.

Cross-chamber Blanking Periods
Cross-chamber blanking periods are designed to promote appropriate sensing of in-chamber events and prevent oversensing of activity in another chamber (cross-talk / far-field sensing). Cross-chamber blanking periods are initiated by paced and/or sensed events in an adjacent chamber. For example, a blanking period is initiated in the right ventricle (RV) each time a pacing pulse is issued in the atrium to avoid detection of the atrial paced event in the RV chamber. Blanking periods are programmable and are described in Figure 1.

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<td>A-Blank after V-Pace</td>
<td>Inhibits atrial sensing following a ventricular paced event</td>
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<td>A-Blank after V-Sense</td>
<td>Inhibits atrial sensing following a ventricular sensed event</td>
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<td>V-Blank after A-Pace</td>
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<td>Inhibits LV sensing following an atrial paced event</td>
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For purposes of this diagram, events in the right ventricle and left ventricle occur simultaneously.

Figure 1. CRT-D refractory and cross-chamber blanking periods.
Programming Cross-Chamber Blanking Periods

Two types of blanking parameters (fixed values or Smart blanking) are available to prevent oversensing events from adjacent chambers:

1. **Fixed values** (e.g., 45 ms, 65 ms, 85 ms, 105 ms, 125 ms)
   
   Programmable fixed values vary by product family and by the specific type of blanking period within each product family.

   **Shorter** fixed values offer:
   
   - Less potential for undersensing in-chamber intrinsic events
   - Greater potential for oversensing cross-chamber artifacts

   **Longer** fixed values offer:
   
   - Greater potential for undersensing in-chamber intrinsic events
   - Less potential for oversensing cross-chamber artifacts

2. **Smart blanking** (when available)

   Smart blanking combines a shorter refractory period (37.5 ms following paced events and 15 ms following sensed events) to reduce undersensing of in-chamber events with an automatic adjustment of the sensitivity to reduce the possibility of detecting cross-chamber artifacts (Figure 2).

   **NOTES:**
   
   - Smart blanking is available for all programmable cross-chamber blanking periods in COGNIS and TELIGEN devices and for the **A-Blank after V-Sense** blanking period in VITALITY 2 and VITALITY AVT devices.
   
   - Sensitivity adjustments associated with Smart blanking may not be sufficient to inhibit detection of cross-chamber artifacts if the cross-chamber artifacts are too large. Consider other factors that impact the size/amplitude of cross-chamber artifacts including lead-placement, pacing output, shock output, and time since last delivered shock.

Patient Considerations

As with all device programming, individual patient needs should be considered when programming cross-chamber blanking periods. For example, when programming the **RV-Blank after A-Pace** cross-chamber blanking period, consider the tradeoff between ventricular oversensing of atrial paced events and ventricular undersensing of PVCs:

- **If RV-Blank after A-Pace** is programmed to a **fixed** value:
  
  - **Longer fixed value**—lessens the potential for oversensing of artifact from the atrial paced event, but increases the potential for undersensing R-waves (PVCs).
  
  - **Shorter fixed value**—lessens the potential for undersensing of R-waves (PVCs), but increases the potential for oversensing of artifact from the atrial paced event.

- **If RV-Blank after A-Pace** is programmed to **Smart blanking**, the device will automatically adjust ventricular sensitivity in an effort to disregard far-field atrial events, while the shorter blanking window will promote sensing of in-chamber ventricular events that might otherwise be hidden by a longer blanking period.
  
  - If Smart blanking is used, consider testing in-clinic for proper sensing after shock delivery, especially if the patient is pacemaker-dependent. If oversensing is occurring post shock delivery, be prepared to use the STAT PACE command.

To promote continuous pacing for **pacemaker dependent patients**, it may be preferable to lessen the potential for ventricular oversensing of atrial paced events by programming a longer blanking period, even though the likelihood of undersensing a PVC may increase (should it occur within the RV-Blank after A-Pace cross-chamber blanking period).
For **patients with sick sinus syndrome and frequent PVCs who are not pacemaker dependent**, it may be preferable to shorten the blanking period to lessen the potential for undersensing a PVC (should it occur simultaneous with an atrial paced event), even though the likelihood for ventricular oversensing of an atrial paced event may increase.

**Post-Therapy System Response**
Residual energy on the defibrillation lead after shock delivery can increase the likelihood of cross-talk / far-field sensing. As this residual energy dissipates with time after shock delivery, the potential for cross-talk / far-field sensing also decreases. To reduce oversensing after shock delivery, a longer fixed value is automatically applied for all cross-chamber blanking periods during the Post-Therapy Period (nominally 30 seconds). See Figure 3 for an example.

- If the cross-chamber blanking period is programmed to a fixed value of **85 ms or less**, or to Smart blanking, then an 85 ms blanking period will be used during the Post-Therapy Period.
- If the cross-chamber blanking period is programmed to a fixed value **longer than 85 ms**, the longer value will be used during the Post-Therapy Period.

**NOTE:** Once the Post-Therapy Period expires, all cross-chamber blanking parameters revert back to their permanently programmed values.

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To reduce oversensing after shock delivery, a longer blanking period is applied during the Post-Therapy Period. This is illustrated in Figure 3 with example ECGs from the Surface, A Channel, RV Channel, and Shock Channel. The figure shows the behavior of the device during this period, with annotations for each channel and the cross-chamber blanking period. The [VS] marker indicates that the artifact falls into the cross-chamber blanking period, while the [AS] marker shows that the artifact falls into the cross-chamber blanking period on the atrial channel following ventricular pace. The Shock Delivered marker highlights the shock delivery timing and its impact on the blanking period.

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Figure 3. Example of device behavior during the Post-Therapy Period.