

# Tech Corner

## ATP in the Fast VT zone

NOTE: PLEASE NOTE THAT THE FOLLOWING INFORMATION IS A GENERAL DESCRIPTION OF THE FUNCTION. DETAILS AND PARTICULAR CASES ARE NOT DESCRIBED IN THE ARTICLE. FOR ADDITIONAL EXPLANATION PLEASE CONTACT YOUR SALES REPRESENTATIVE.

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## AVAILABILITY

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This function is available on all MicroPort ICDs.

## DEFINITION

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The fast VT zone offers the possibility to attempt painless ATP to terminate fast ventricular arrhythmias in a defined portion of the VF zone.

## INDICATION

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All patients are indicated for ATP for fast VT. Programming Fast VT ATP should be carefully considered for patients with a history of VF, as ATP may delay shock delivery.

It is the “philosophy” of MicroPort ICD and CRT-D devices to avoid shocks unless absolutely necessary. The use of ATP in the VF zone is encouraged wherever appropriate. It allows decreasing the number of unnecessary shocks.

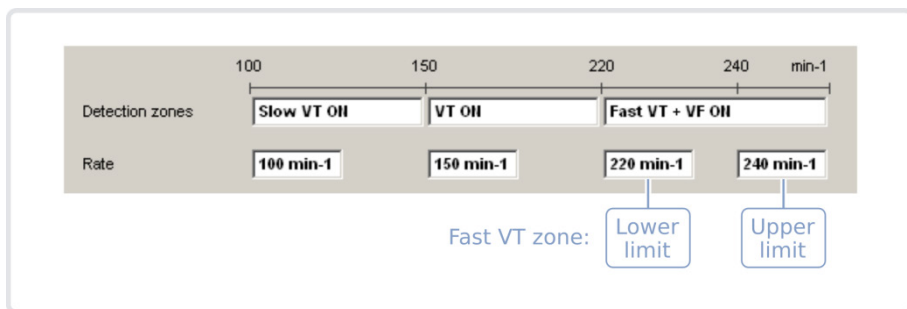
## DESCRIPTION OF THE FUNCTIONING

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### Programming the Fast VT + FV zone

On the Tachy tab on the Parameters screen, select « Fast VT + VF ON ».

Once the zone is ON, select the lower limit and upper limit of the zone (see below).



*Note:* For the programmable lower and upper rates of the fast VT zone, please refer to the device's technical specification sheet.

## Lower and upper limits of the Fast VT + VF zone

The lower limit of the Fast VT + VF zone is also the lower limit for VF detection.

The upper limit of the Fast VT zone defines the upper limit that arrhythmias can be treated with ATP. Arrhythmias faster than the upper rate of the Fast VT zone will be analysed as ventricular fibrillation (VF) and will be treated directly with shock therapy.

## RHYTHM ANALYSIS IN THE FAST VT/VF ZONE

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### VF majority and persistence

A rhythm entering the Fast VT+VF zone will be first analyzed on the rate criterion:

- If 6 cycles or more out of the last 8 are faster than the lower limit of Fast VT+VF zone, the device declares that a Fibrillation rhythm is going on: **VF majority** is reached and the persistence counter starts.
- Each additional cycle in the Fast VT + VF zone adds to the **persistence** count until the persistence count reaches the programmed number<sup>1</sup>

Persistence is reset by a change in majority and not by therapy, so after ATP delivery only the majority needs to be reconfirmed before capacitors start charging.

The programmed persistence is for both Fast VT and VF rhythms.

PARAD/PARAD+ algorithm will not be used to analyze arrhythmias comprised within the Fast VT+VF zone (there is no SVT/ST discrimination in the Fast VT + VF zone).

Note: For more details on the majority and persistence, see the Tech Corner on “Tachyarrhythmia Suspicion and Detection”).

<sup>1</sup> As-shipped value: 6 cycles

## Criteria to discriminate between Fast VT and VF

A second analysis will be performed during the persistence in order to classify the rhythm as fast VT or VF and apply the adequate therapy: ATP or shock respectively. During the persistence, two types of analysis can be programmed:

- Rate only
- Rate + Stability

### Rate only

Once the VF majority has been found and the persistence has been reached, the device checks:

- If the last 4 cycles of the persistence are all slower than the upper limit of the Fast VT zone
- If the average of the last 4 cycles is within the Fast VT zone (between the lower and the upper limits programmed).

If both conditions are met, ATP will be delivered. If not, the device starts charging the capacitors and will deliver the shock if the rhythm is confirmed all along the charge.

### Rate + Stability

Once the VF majority has been found and persistence has been reached, the device checks:

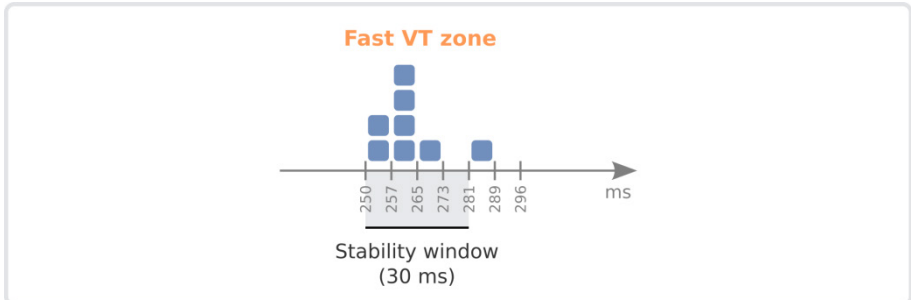
- If the last 4 cycles of the persistence are all slower than the upper limit of the Fast VT zone
- If the average of the last 4 cycles is within the Fast VT zone (between the lower and the upper limits programmed)

AND

- If the rhythm is stable: it will be classified as stable if at least 6 out of the last 8 cycles back from the end of the persistence can be collected inside a 30 ms stability window and are faster than the lower limit of the Fast VT zone (i.e. within the Fast VT + VF zone).

If all conditions are met, ATP will be delivered. If one of them is not met, the device starts charging the capacitors and will deliver the shock if the rhythm is confirmed all along the charge. No ATP can now be delivered.

## Example of the stability analysis:



Fast VT zone programmed from 210 bpm to 240 bpm (285 ms to 250 ms): The blue squares represent the last 8 RR intervals back from the end of the persistence: at least 6 out of the 8 are within a 30 ms stability window (here 7 intervals) and are faster than the lower limit of the Fast VT zone, so the stability criteria is met.

## AVAILABLE THERAPIES IN THE FAST VT + VF ZONE

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### ATP

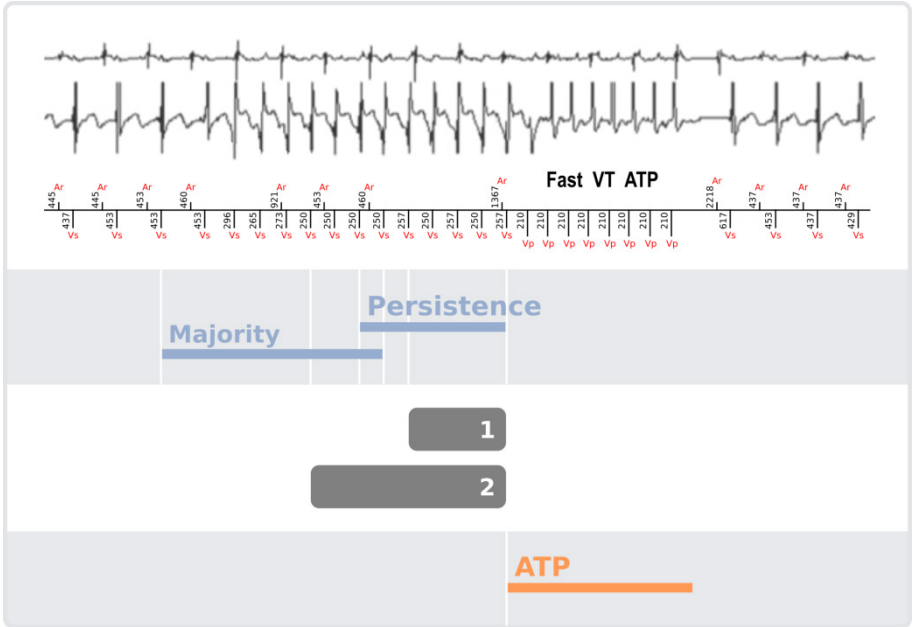
When a rhythm has been classified as a fast ventricular tachycardia (Fast VT) based on the “Rate only” or “Rate + Stability” criteria described above, the device delivers the ATP programmed in the Fast VT zone.

One ATP scheme is programmable in the Fast VT + VF zone. This scheme can be up to 15 sequences with all ATP options available.

ATP programs: For a full range of programmable ATP in the fast VT zone, please refer to the device's technical specifications sheet.

**Note:** Caution should be taken in programming more than 2 sequences of ATP as failed ATP will delay a definitive shock (as-shipped = 1 sequence).

**Example:**



**Fast VT zone programmed from 210 bpm to 240 bpm (285 ms to 250 ms)**

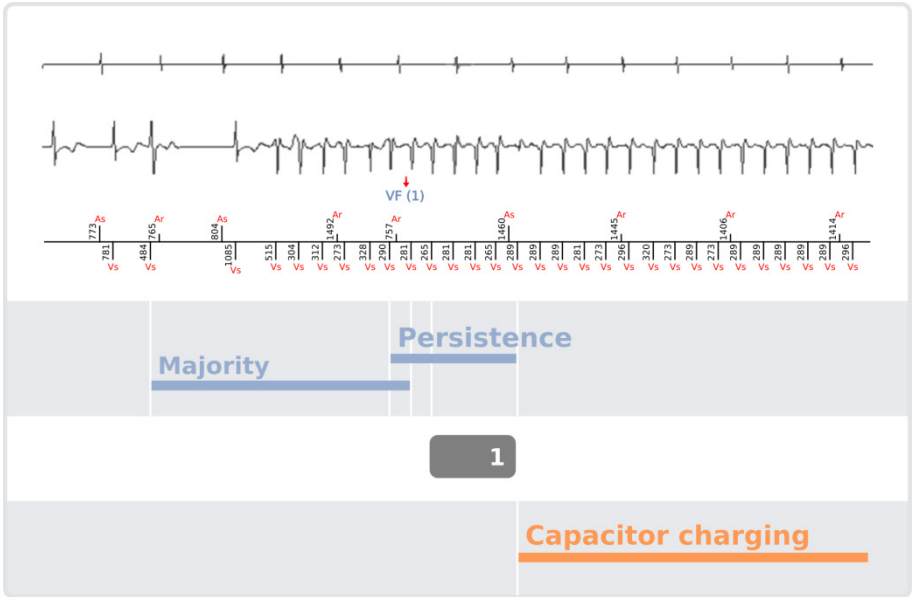
**Therapy**

- 1 Rate criteria is **met**: each of the last 4 cycles of the persistence is in the Fast VT zone (250 – 285 ms) and the average as well
- 2 Stability criteria is **met**: at least 6/8 ventricular cycles are within a 30 ms window and are within the Fast VT+VF zone

**The device applies ATP therapy**

# Shock

When a rhythm has been classified as a ventricular fibrillation (VF) based on the “Rate only” or “Rate + Stability” criteria described above, the device starts charging the capacitors and then apply the first programmed shock of the “fast VT + VF” zone.



**Fast VT zone programmed from 180 bpm to 220 bpm (330 ms to 270 ms):**

**Therapy**

**1**

Rate criteria is **not met**: one of the last 4 cycles (265 ms) of the persistence is not in the Fast VT zone

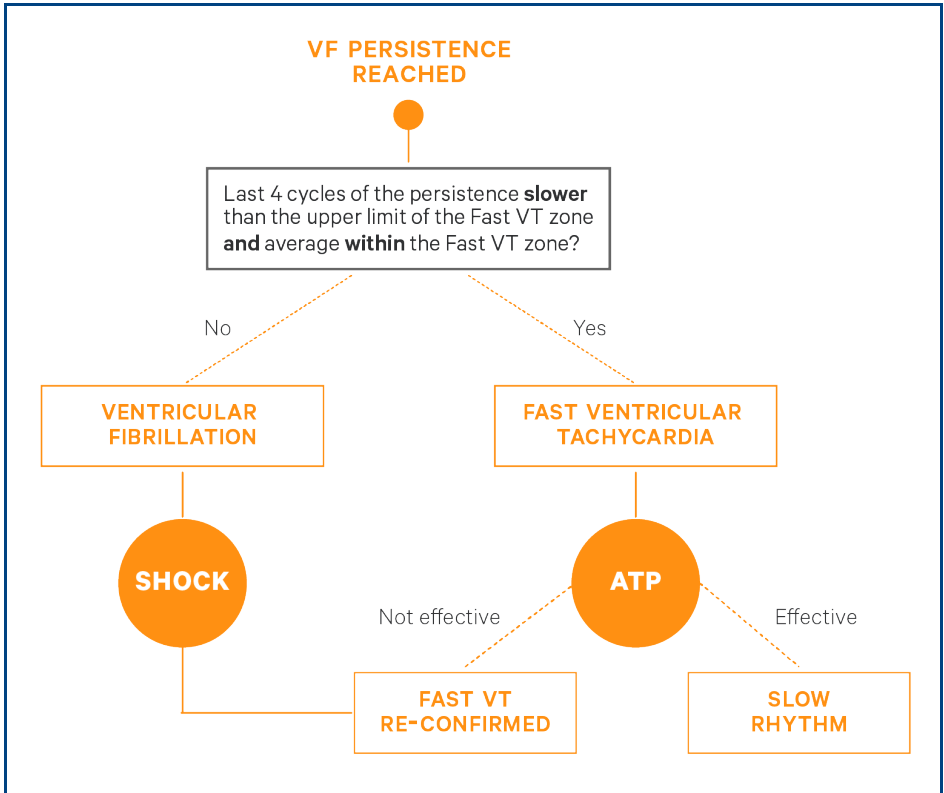
**The device starts charging the capacitors and will apply the first programmed shock of the Fast VT + VF zone**



# SUMMARY OF DISCRIMINATION AND THERAPIES

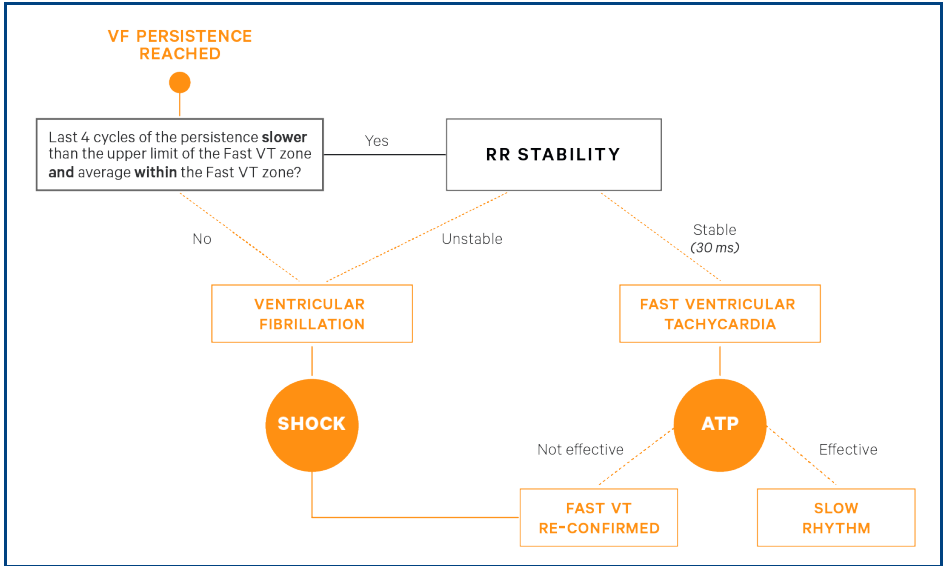
## Discrimination

### Rate only



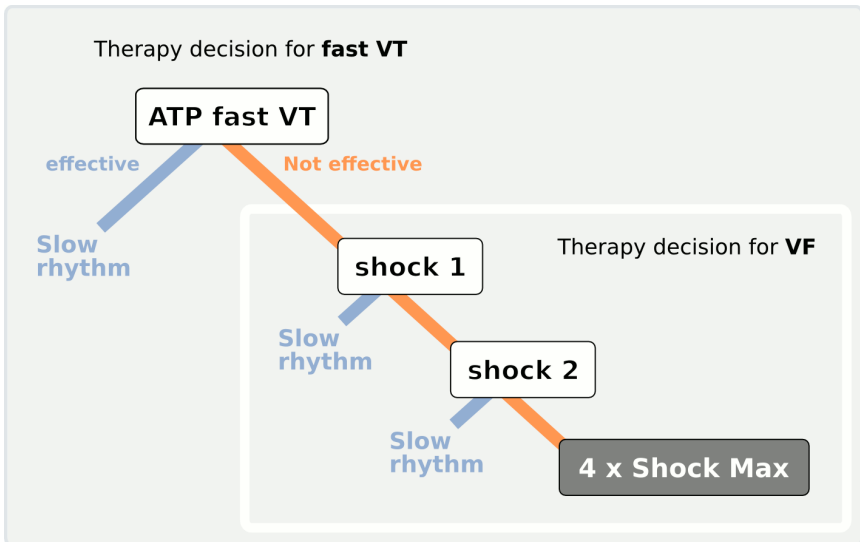
Discrimination algorithm "Rate only" in the Fast VT + VF zone

## Rate + Stability



Discrimination algorithm "Rate + Stability" in the Fast VT + VF zone

## Therapy



Therapy delivered in the "Fast VT + VF" zone

## STUDIES AND RESULTS

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PAIN FREE RxII, Mark S. Wathen, Circulation 2004;110:2591-2596

### Background

Successful antitachycardia pacing (ATP) terminates ventricular tachycardia (VT) up to 250 bpm without the need for painful shocks in implantable cardioverter-defibrillator (ICD) patients. Fast VT (FVT) > 200 bpm is often treated by shock because of safety concerns, however. This prospective, randomized, multicenter trial compares the safety and utility of empirical ATP with shocks for FVT in a broad ICD population.

### Methods and Results

634 ICD patients were randomized into 2 arms - standardized empirical ATP (n=313) or shock (n=321) - for initial therapy of spontaneous FVT. ICDs were programmed to detect FVT when 18 of 24 intervals were 188 to 250 bpm and 0 of the last 8 intervals were > 250 bpm. Initial FVT therapy was ATP (8 pulses, 88% of FVT cycle length) or shock at 10 J above the defibrillation threshold. Syncope and arrhythmic symptoms were collected through patient diaries and interviews. In 11 +/- 3 months of follow-up, 431 episodes of FVT occurred in 98 patients, representing 32% of ventricular tachyarrhythmias and 76% of those that would be detected as ventricular fibrillation and shocked with traditional ICD programming. **ATP was effective in 229 of 284 episodes in the ATP arm (81%, 72% adjusted).** Acceleration, episode duration, syncope, and sudden death were similar between arms. Quality of life, measured with the SF-36, improved in patients with FVT in both arms but more so in the ATP arm.

### Conclusions

Compared with shocks, empirical ATP for FVT is highly effective, is equally safe, and improves quality of life. ATP may be the preferred FVT therapy in most ICD patients.

### Comments by MicroPort

In this study there was no stability analysis of the fast rhythm, so the 81% success reported may well be higher with the unique stability analysis filtering by MicroPort ICDs.

Refer to user's manual furnished with the device for complete instructions for use ([www.microportmanuals.com](http://www.microportmanuals.com)).