Tech Corner

Dplus pacing mode

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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Dplus pacing mode

Dplus pacing mode is an automatic AV Delay (AVD) hysteresis algorithm, designed to promote the spontaneous atrio-ventricular (AV) conduction. The "Acceleration" and "AVD shortening" functions can also be programmed simultaneously to better sustain the patient avoiding the sudden rate drops, for example during vaso-vagal episodes. Availability in some specific models (see below).

AVAILABILITY

Dplus pacing mode is programmable on the following MicroPort CRM devices:

- ALIZEA DR
- BOREA DR
- CELEA DR
- ENO DR
- TEO DR
- OTO DR
- KORA 250 DR
- KORA 100 DR
- REPLY CRT-P
- REPLY 200 DR
- REPLY DR, REPLY D[1]
- ESPRIT DR, ESPRIT D

SYNONYMS

- DDD/AMC pacing mode: former name of Dplus, available in previous MicroPort pacemaker ranges.
- DDD + automatic AVD hysteresis algorithm.

[1] *only REPLY devices with ZU or ZV letters in serial number*

INDICATIONS

The Dplus pacing mode is indicated for:

- Sick Sinus Syndrome,
- Brady Tachy Syndrome, or
- Paroxysmal AV conduction diseases.

In addition, the Acceleration and AVD shortening algorithms are indicated for patients with sudden drops in cardiac rate and concomitant AV blocks that are encountered in the following clinical situations:

- Carotid sinus syndrome, or
- Vasovagal syncope.

DESCRIPTION OF DPLUS FUNCTIONING

Dplus is an automatic AVD hysteresis algorithm. The algorithm is designed to work with an automatic extended AVD allowing intrinsic AV conduction (also called pseudo-AAI) as long as the AV conduction is physiologic. Dplus switches from pseudo-AAI into DDD when the AV conduction worsen. While in DDD functioning, Dplus extends the AVD, periodically and under specific circumstances, to promote the spontaneous AV conduction.

Dplus technology is based on:

- Switch between “pseudo-AAI” and DDD and vice versa,
- Extended AVD (AVD hysteresis),
- Automatic adjustment of the AVD in DDD and “pseudo-AAI”.

Pseudo-AAI functioning

The “pseudo-AAI” functioning is basically a DDD pacing mode with an extended AVD. During the “pseudo-AAI” phase of Dplus, the device/algorithm:

- Monitors the spontaneous AV conduction,
- Applies an extended AVD equal to the average of last 8 PR/AR + AVD hysteresis (50 ms),
- Automatically adjusts the Rest, Exercice and Offset AVDs, which will be applied in DDD mode, on the basis of the intrinsic conduction of the patient.

Criterion to switch from pseudo-AAI to DDD

As soon as an AV block occurs (the AV conduction worsens), V pacing is delivered at the end of the extended AVD. The device immediately switches into DDD.

DDD functioning

While in DDD functioning, Dplus immediately applies an automatic AVD based on the AVDs at rest and exercise and the AVD offset which have been automatically calculated from the PR and AR measurements performed during "pseudo-AAI" functioning. Consequently, during DDD functioning, the length of the AVD is very close to the intrinsic PR/AR intervals.

Note: Due to the fact that the AVD during DDD functioning is calculated from the measurements of PR and AR intrinsic intervals during "pseudo-AAI", it is not recommended to use Dplus in first degree AV block Patients.

The longest AVD duration which can be applied is

- 300 ms post atrial sensing, and
- 345 ms post atrial pacing.

While in DDD functioning, the device extends the AVD by 50 ms to promote the switch into "pseudo-AAI":

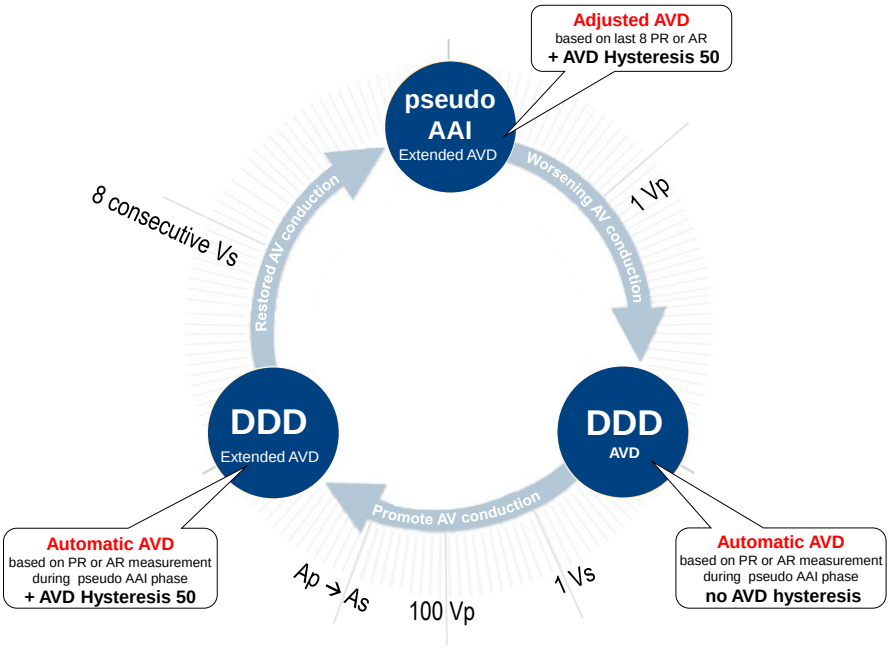
- After one normal sensed ventricle for the next ventricular cycle,
- Periodically after 100 consecutive paced ventricles for the next 5 cycles, or
- Atrial rhythm changes from being paced to being sensed for the next 5 cycles.

The device is searching for sensed ventricle inside the AVD (extended by 50 ms).

Criterion to switch from DDD to pseudo-AAI

The device switches from DDD into "pseudo-AAI" after 8 consecutive cycles with conducted R-waves inside the AVD (extended by 50 ms), meaning after 8 consecutive PR or 8 consecutive AR.

Dplus functioning in summary



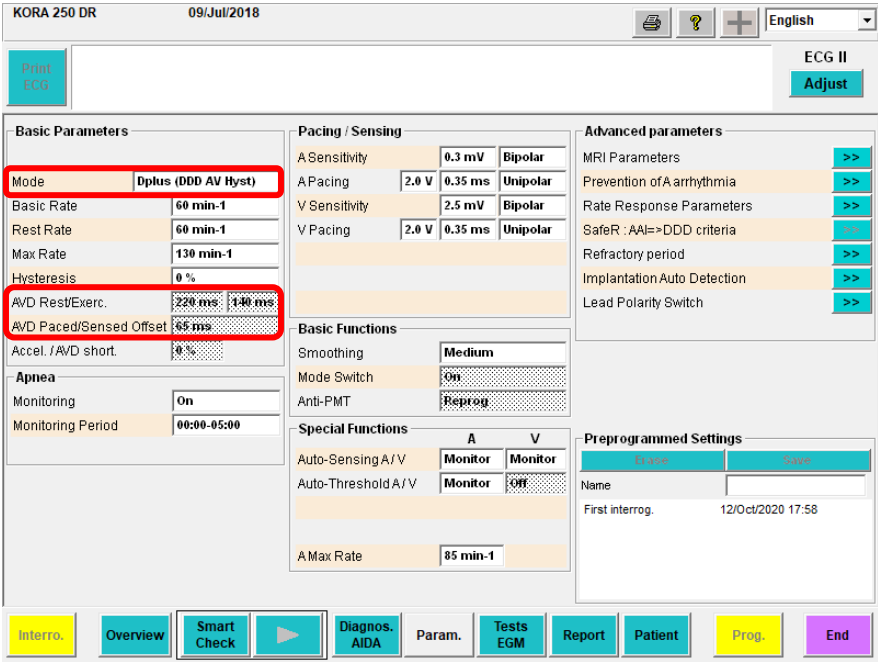
Summary of Dplus functioning

Programmable parameters

Dplus pacing mode is available on the Basic Parameters section (Dplus, Dplus-R, Dplus/DDIR):

- The Dplus-R mode is a Dplus mode with Rate Response,
- The Dplus/DDIR mode is a Dplus mode with Rate Response only during Mode Switch.

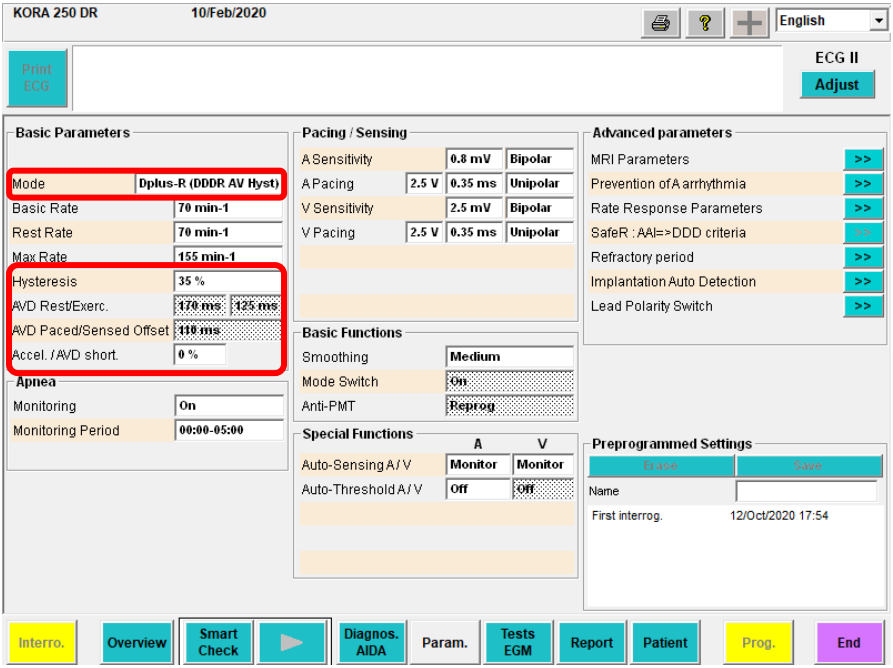
Activation of Dplus pacing mode



Activation of Dplus pacing mode. AVD is automatically calculated.

Activation of Dplus pacing mode with “Acceleration” algorithm

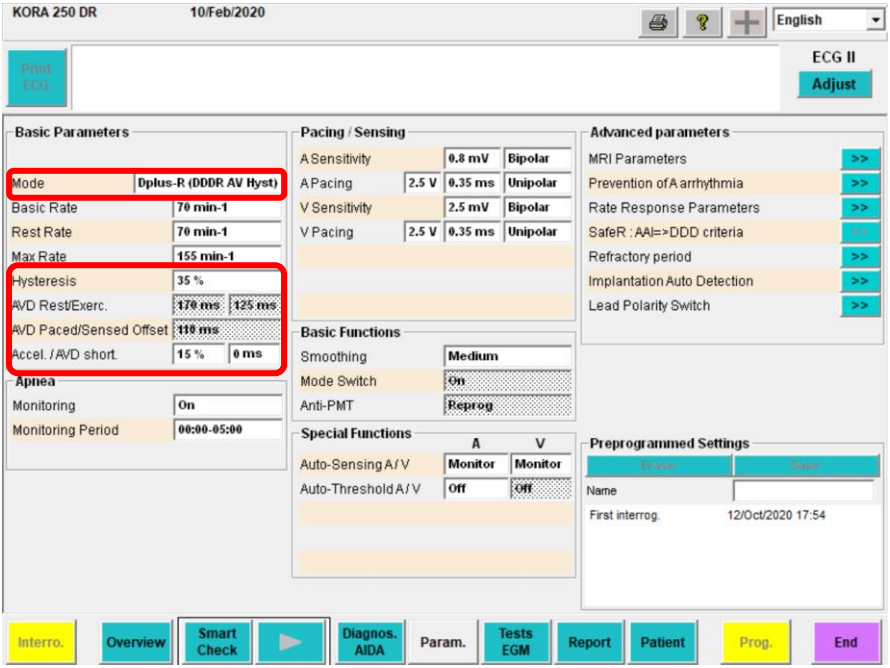
In order to access to “Acceleration” function, program rate Hysteresis with a value different from 0%.



Activation of Dplus pacing mode. Acceleration algorithm is available when rate Hysteresis is set to a value other than 0%.

Activation of Dplus pacing mode with “AVD shortening”

To access to “AVD shortening” function, program Acceleration with a value different from 0%.



Activation of Dplus pacing mode. AVD shortening function is available when Acceleration is set to a value other than 0%.

PROGRAMMING CONSTRAINTS

When Dplus is programmed (Dplus, Dplus-R, Dplus/DDIR):

- Fallback mode switch is forced to “ON”,
- Anti-PMT is forced to “Reprog”,
- Rate Smoothing is enabled and set by default to “Medium” value (can be reprogrammed to another value),
- (Rate) Hysteresis is set by default to 20%* (can be reprogrammed to another value),
- Ventricular Autothreshold is deactivated for all pacemakers, except ALIZEA, BOREA and CELEA,
- AV delays are allowed in the following limits:
  - Rest AVD, between 170 and 250 ms
  - Exercise AVD, between 80 and 155 ms
  - AVD Paced/Sensed Offset, limited between 31 ms and 125 ms
- Allowed total duration between an atrial event and a paced ventricular is limited to 300 ms post sensed atrium and 345 ms post paced atrium.

*: When rate Hysteresis is also activated (value other than 0%), the Acceleration algorithm is available.

CLINICAL REFERENCES

1. Himmrich E, Krämer L I, Fischer W et al. Support of spontaneous atrioventricular conduction in patients with DDR(R) pacemakers: effectiveness and safety. Herz . 2001 Feb;26(1):69-74.

   IRUM 03 study
   "Ventricular stimulation was significantly less often in the DDD/AMC mode than in the DDD mode (15 ± 17% vs. 48 ± 37%, p < 0.001)."

2. Davy JM, Hoffmann E, Frey A et al. Near elimination of ventricular pacing in SafeR mode compared to DDD modes: a randomized study of 422 patients. Pacing Clin Electrophysiol 2012;35:392-402

   SAVE-R study
   "At 1 year, mean %Vp in SafeR was 4.5±15.3 % versus 37.9±34.4 % and 16.7±28.0 % in DD/AMC and DDD/LD modes, respectively (p<0.0001 for both)."

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