



# IntelliSpace Perinatal Dawes/Redman CTG Analysis

## Application Note

### **Introduction**

This Application Note is designed to provide clinicians with a description of the IntelliSpace Perinatal revision J.00.21 Dawes/Redman Cardiotocogram (CTG) analysis and Non-stress Test (NST) interpretation. The Application Note does not replace the Instructions for Use (IFU) documentation. It is recommended prior to initial use to read, understand, and follow the IFU document.

The topics presented in this note are:

- Dawes/Redman Algorithm
- Application
- Non-Stress Test (NST)

# PHILIPS

## Dawes/Redman Algorithm

IntelliSpace Perinatal revision J.00.21 offers the Dawes/Redman 2002 CTG algorithm as a choice for fetal CTG and non-stress test analysis in the application. Philips recognizes a clinician's obligation to adhere to professional practice standards when caring for pregnant women and their unborn children. To support our customers, Philips has produced the Dawes/Redman 2002 CTG algorithm in the IntelliSpace Perinatal J.00.21 software. This algorithm and its resultant analysis has been reviewed, verified and validated by clinical experts in the field of Obstetrics.

The design principles for the Dawes/Redman algorithm implementation are to first identify the trace components and then apply the algorithm rules. The analysis evaluates the criteria against the presence of Fetal Heart Rate (FHR) accelerations and decelerations. It estimates FHR baseline, short-term variation, long-term variation, basal heart rate and sinusoidal patterns.

A key principle of the algorithm is to identify episodes of low and high FHR variation. Variation is generally understood to be fluctuations in the FHR baseline which are irregular in amplitude and frequency. The Dawes/Redman criteria classify the variation as low or high FHR variation. For each minute of the trace the maximum excursions of the FHR above and below the baseline are calculated. The sum of these two values is the minute range. The average of consecutive minute ranges is the mean range and is used to measure the long term variation. (Pardey, J. et al, 2002)

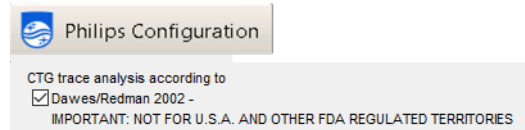
Classification	Condition
Low FHR variation	When the minute range in at least 5 of 6 consecutive 1-minute intervals is less than, or equal to, a threshold defined by a pulse interval of 30 ms
High FHR variation	When the minute range in at least 5 of 6 consecutive 1-minute intervals is greater than, or equal to, a threshold defined by a pulse interval of 32 ms and the mean minute range over the entire episode is above the first centile in the distribution of mean minutes ranges for episodes of high variation in healthy fetuses at that gestational age

Short term variation is averaged in milliseconds (ms) based on the averaged epochs of 3.75 seconds (1/16 minute). The short term variation is calculated by discarding the minutes containing all or part of the decelerations and calculating the difference between the average pulse interval values for adjacent epochs. These pulse interval differences are then averaged over one minute, and the 1-minute averages are in turn averaged over the entire NST to give the short term variation in milliseconds.

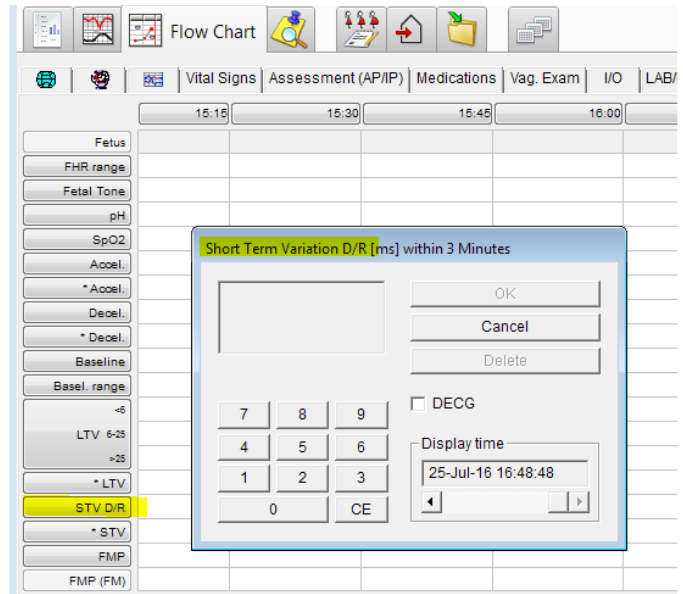
The Dawes/Redman guidelines use different parameters for interpretation in comparison to the National Institute of Child Health and Development (NICHD). Therefore the Dawes/Redman algorithm is not available for the U.S.A. and other FDA regulated territories.

## Application

The decision to configure the Dawes/Redman algorithm for the IntelliSpace Perinatal system should be considered prior to system set up. Once the choice of Dawes/Redman 2002 has been configured for the system it can be verified in Configuration/Philips tab/System Settings, as noted below.

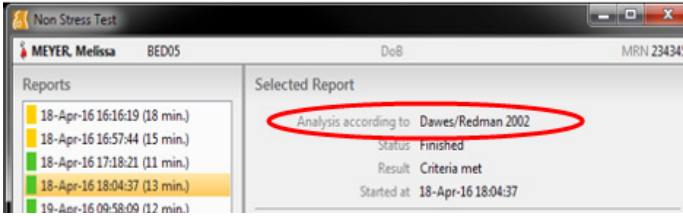


The Dawes/Redman short term variation value will be available in the Flowchart for autocharting. The long term variation value will not be available for autocharting. The application user interface will distinguish the Dawes/Redman short term variation within the product with the following label: Short Term Variation D/R.



## Non-Stress Test

When Dawes/Redman 2002 is configured for the IntelliSpace Perinatal system, the NST analysis will be performed according to these criteria. This will be indicated in the NST window for the patient in focus.



A trace is considered reassuring whenever the following criteria are met within the time range of 10 - 60 minutes:

- The recording must contain at least one episode of high variation
- The short term variation (STV) must be greater than 3.0 milliseconds (ms). If STV is greater than 3.0 ms but less than 4.5 ms, the long term variation (LTV) averaged across all episodes of high variation must be greater than the third percentile for the gestational age (GA)
- There must be no evidence of a high-frequency sinusoidal rhythm
- There must be either:
  - at least one acceleration, **or**
  - a fetal movement rate of  $\geq 20$  per hour, **and** an LTV averaged across all episodes of high variation that is greater than the 10th percentile for the GA
- There must be at least one fetal movement or three accelerations
- Concerning decelerations:
  - If the recording time is less than 30 minutes, there must be no decelerations of more than 20 lost beats.
  - If the recording time is more than 30 minutes, there must be no more than one deceleration of 21-100 lost beats.
  - Independent of recording time, there must be no decelerations at all of more than 100 lost beats
- If the recording time is less than 30 minutes, the basal heart rate must be in the range 116- 160 bpm
- The LTV must be within three standard deviations (SDs) of its estimated value. Alternatively, if it is not, all the following must apply:
  - the STV must be larger than 5.0 ms
  - there must be an episode of high variation with  $\geq 0.5$  fetal movements per minute
  - the basal heart rate must be  $\geq 120$  bpm
  - the signal loss must be smaller than 30%
- The final epoch of the recording
  - must not be part of a deceleration, if the recording time is less than 60 minutes
  - can include a deceleration at 60 minutes but this must not be larger than 20 lost beats
- If the recording time is less than 60 minutes, there must be no suspected artifacts at the end of the recording

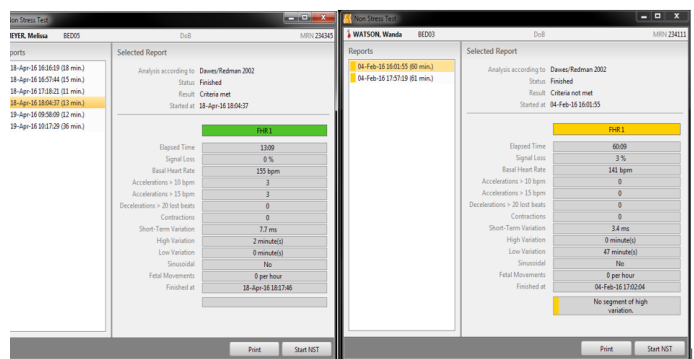
## Note:

- Fetal movements are maternally perceived fetal movements. To acquire these movements, a fetal monitor marker button is required, and the patient or a clinician is required to press the marker button whenever fetal movements are perceived.
- Lost beats in association with decelerations are the number of fetal heart rate beats missing due to the reduced FHR during the deceleration compared to the baseline.  
Example: if the baseline is 140 bpm, and there is a deceleration with a duration of 1 minute, and a decreased FHR of 100 bpm in average, the number of lost beats would be  $140 - 100 = 40$  bpm
- Though the analysis time range is from 10 to 60 minutes, the NST duration may be up to 65 minutes. This is due to processing delays as part of the algorithms (for example: classification of high/low long-term variation).

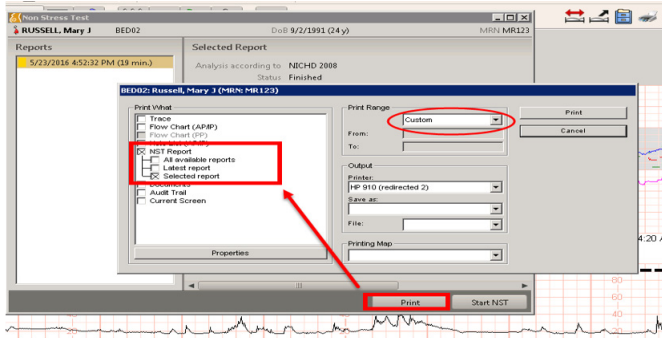
The range and limits of the Dawes/Redman parameters are pre-configured and cannot be changed. When applying the criteria, the following ten parameters are calculated for an NST:

- Signal loss
- Baseline
- Acceleration
- Deceleration
- Contractions
- Short term variation
- High long term variation
- Low long term variation
- Sinusoidal
- Fetal movement

The NST window will display the criteria in use and the parameters that are analyzed. It will indicate if the criteria have been met by displaying a green bar. If any of criteria have not been met, a yellow bar will be displayed with analysis details to notify the user which criteria have not been met.



When an NST test is finished or has been stopped, the data is written to a file. The NST report can be printed from the NST window or via the Printer icon. In revision J.00.21, the user can select to print directly from the NST window: All available reports, Latest report or the Selected report.



The following is an example of the Dawes/Redman NST report.

```

NST Report for FHR1:                               25-Jul-16
-----
Address of system installation
-----
Doe Diana
Age: 27
Gestational Age (week/day): 32/1
-----
Monitoring Period
Time: 16:41 - 16:55
FHR1: US
FHR2: US
FHR3: No transducer
TOCO: external
Duration: 14 minutes
-----
NST Criteria*: met
-----
Trace Interpretation Summary. Reporting time range: 14 minutes.
Signal Loss: 1 %
Basal Heart Rate: 148 bpm (range: 146 bpm - 150 bpm)
Accelerations > 10 bpm: 7
Accelerations > 15 bpm: 7
Decelerations > 20 lost beats: 0
Short-Term Variation: 7.3 ms
High Variation: 2 minute(s)
Low Variation: 0 minute(s)
Sinusoidal: No
Fetal Movements: 0
(Maternally perceived fetal movements are indicated by use of the remote event marker)

Accelerations: 7
at: 16:42 16:44 16:47 16:48 16:50 16:52 16:53

Decelerations: 0

Contractions: 3
at: 16:41 16:45 16:50
-----
(*) Analysis according to Dawes/Redman 2002

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**References:**

James Pardey, Mary Moulden, Christopher Redman: A computer system for the numerical analysis of nonstress tests, American journal of obstetrics and gynecology, vol 186 nr 5, 2002



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