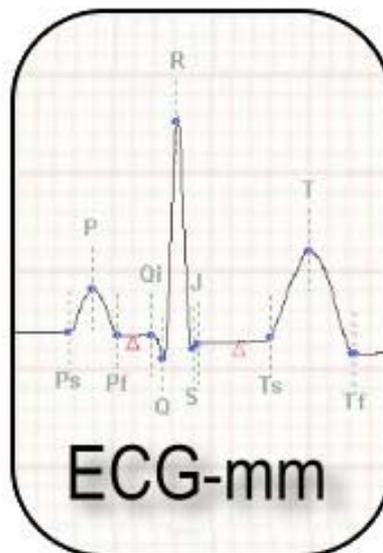




GALIX

BIOMEDICAL INSTRUMENTATION, INC.

ECG-PS ECG SIGNAL MEASUREMENT MODULE



Operation Manual

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1. INTRODUCTION

The ECG signal measurement module is a very useful tool that allows the physician to analyse a particular heart beat. The information provided by this module includes amplitude, time interval and electric axis measurements.

This module consists of four main screens, each of which enables different actions. These screens are:

- Standard measurement screen.
- Beat comparison screen.
- Manual measurement screen.
- Measurement table screen.

The standard measurement screen shows all the measurements that are automatically performed by the program on each of the 12 leads.

The beat comparison screen is used to compare the morphology of two beats, allowing the user to measure differences in time and amplitude between them.

By means of the manual measurement screen the user can measure amplitude and time intervals in any of the 12 leads.

The measurement table allows a quick visualization of the all the values of the different measurements performed for each of the 12 leads.

2. ACCESING THE MODULE

This module can be accessed from the “Monitoring Screen” in the ECG and ERGO programs. We will describe the procedure that needs to be performed for accessing the module from the ERGO program, but the same is valid for the ECG program.

1. Turn on the computer.
2. Double click on the ”ERGO - PS” icon in the desktop in order to access the ERGO program.
3. A screen will appear prompting the user to enter the names of the patient and physician. Press on “OK” to continue.
4. A new screen will be displayed asking the user to confirm all the information belonging to the patient. Select “OK” to continue.
5. The program will automatically access the ERGO Monitoring Screen (Figure A). Click on the icon  in the Monitoring Control Bar to begin the ECG signal acquisition.

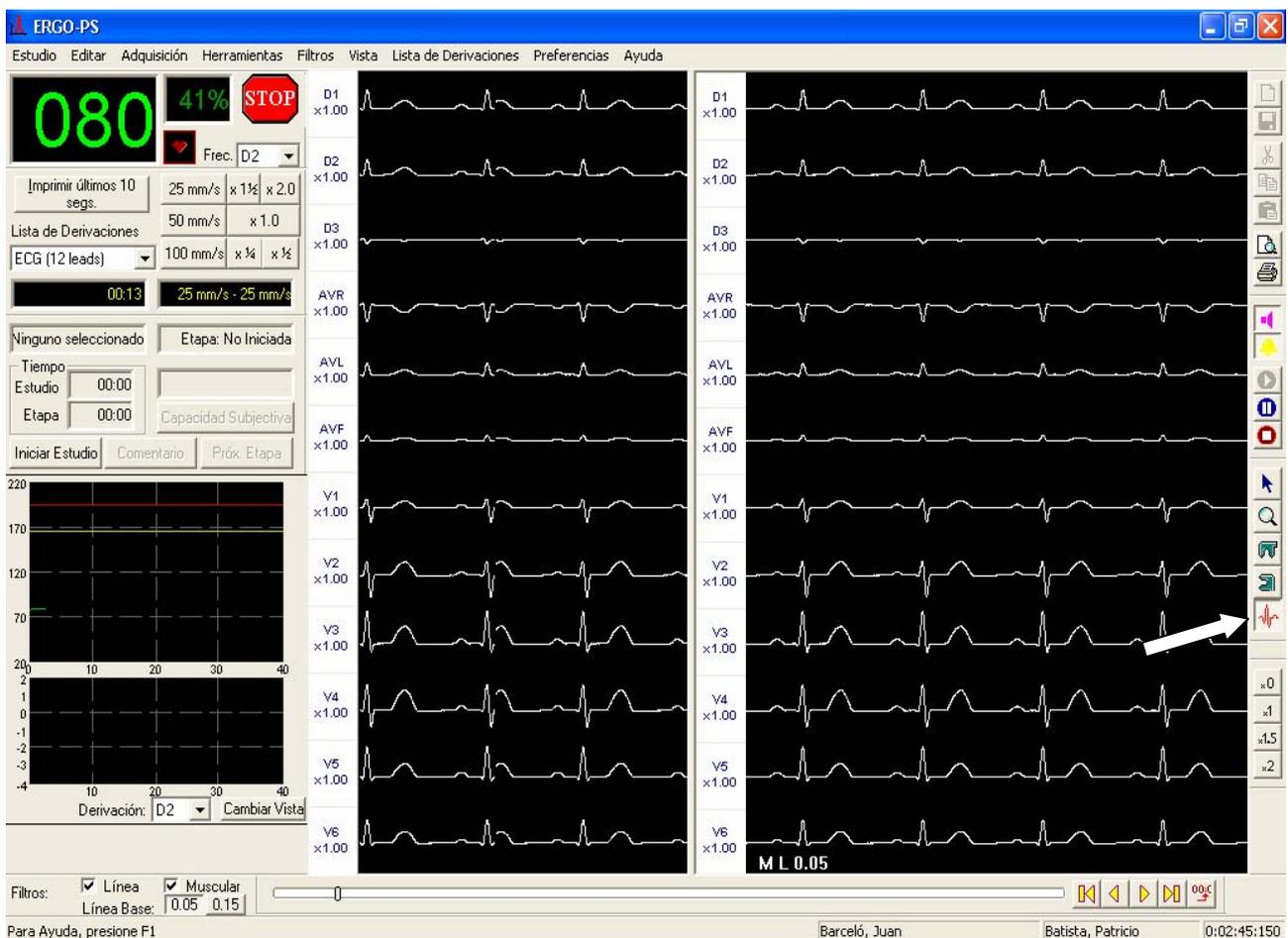


Figure A

6. Locate the icon  in the Tool Bar (white arrow in Figure A) and click on it.
7. Select the beat on which you want to perform measurements, clicking on it with the left button of the mouse.
8. The program will automatically access the standard measurement screen (Figure B).

3. STANDARD MEASUREMENT SCREEN

The aim of this screen is to help the physician with the beat analysis task. This screen provides the following information: displays the 12 leads of the selected beat and allows visualization of the automatic measurements performed on the selected lead. It also allows the user to manually edit those measurements.

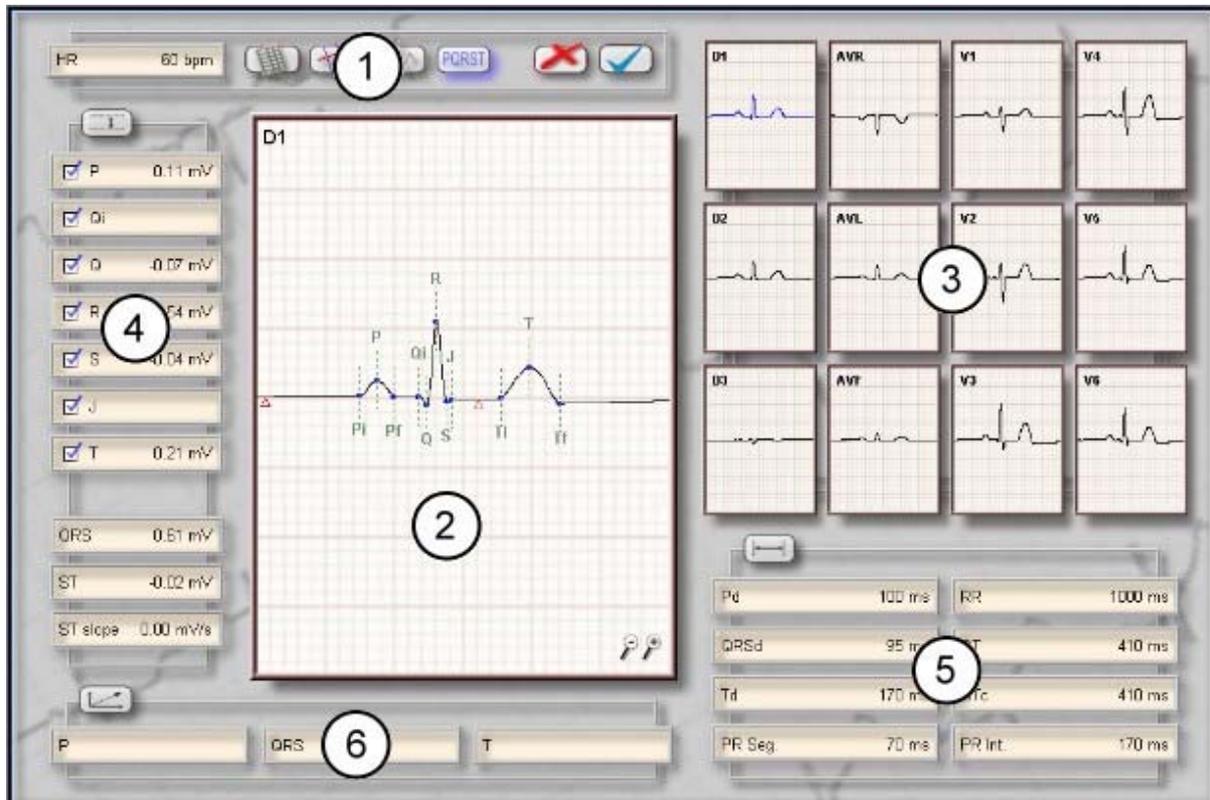


Figure B

Operation instructions:

- **Lead selection:** Click on the lead you want to perform measurements with the left button of the mouse. The selected lead will be displayed in blue.
- **Move a characteristic point:** Select the point of interest in the measurement visualization grid (item 2 in Figure B) by clicking on it with the left button of the mouse. Then drag it until the desired position without releasing the left button of the mouse.
- **Move the ECG signal:** Click on the ECG signal with the right button of the mouse, and without releasing it, drag the signal to the desired position.
- **Zoom in / zoom out:** Click on the + and - zoom icon options with the left button of the mouse to increase or decrease the ECG signal amplitude.

- **Enable amplitude measurements:** In order to display the graphic representation of the amplitude measurements (item 4 in figure B), click on the box next to each measurement with the left button of the mouse. The selected points will be marked as follows: .
- **Show a particular ECG signal measurement:** Move the mouse to the desired measurement (items 4, 5 and 6 in Figure B). The characteristic points will disappear and the corresponding measurement will be displayed in the ECG signal. Furthermore the value of that measurement for each one of the leads will be displayed in the lead selection box (item 3 in Figure B).

3.1. Control bar

The control bar is located in the upper left area of all screens. This bar allows the user to access the different screens. All the changes made in one screen will be automatically translated to the rest of the screens.

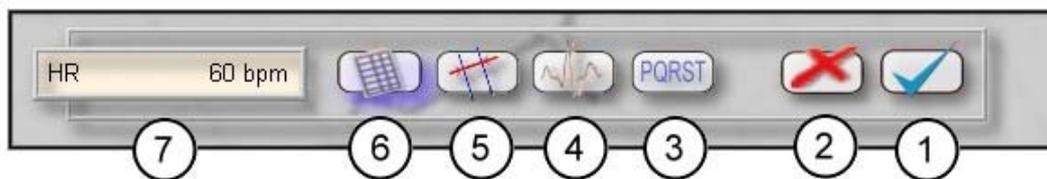


Figure C

The items indicated above are used to:

1. Exit the module saving all changes made.
2. Exit the module without saving changes.
3. Go to the standard measurement screen.
4. Go to the beat comparison screen.
5. Go to the manual measurement screen.
6. Go to the measurement table screen.
7. Displays the heart rate.

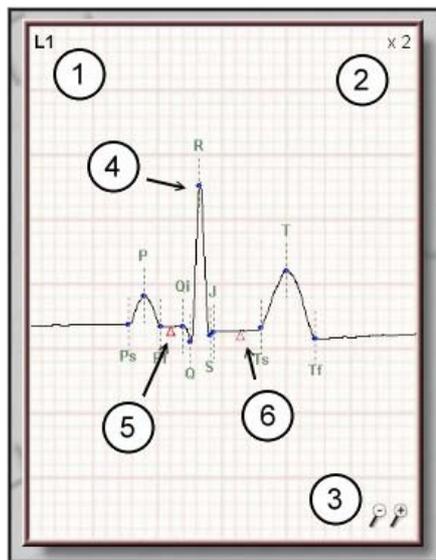
3.2. Measurement visualization grid

This box displays the selected lead for a particular heart beat, as well as the characteristic points automatically detected by the system, which are shown below:

| | |
|--------------|--|
| P wave: | <i>P_i: Beginning</i> <i>P: Maximum</i> <i>P_f: End</i> |
| QRS complex: | <i>Q_i: Beginning of the Q wave and/or the QRS complex</i> <i>Q: Maximum value of the Q wave</i> <i>R: Maximum value of the R wave</i> <i>S: Maximum value of the S wave</i> <i>J: J point, end of QRS</i> |

| | |
|-----------------------|---|
| T wave: | <i>Ti: Beginning</i> <i>T: Maximum</i> <i>Tf: End</i> |
| Isoelectric point: | <i>Indicated as a red triangle</i> |
| ST measurement point: | <i>Indicated as a brown triangle</i> |

The following figure shows all the information provided by the measurement visualization grid:



1. Selected lead.
2. Gain indication.
3. Zoom.
4. Characteristic points.
5. Isoelectric level.
6. ST-segment measurement point.

Figure D

The program performs the following measurements:

- Enable amplitude measurements (item 4 in Figure B):

P P wave amplitude.

Q Q point amplitude.

R R point amplitude.

S S point amplitude.

T T wave amplitude.

QRS QRS complex amplitude.

ST ST-segment amplitude.

ST slope ST-segment slope.

- Time interval measurements (item 5 in Figure B):

Pd P wave duration.

RR Interval between the maximum values of present R wave and previous R wave.

PR Seg. Interval between the end of P wave and the beginning of QRS complex.

PR Int. Interval between the beginnings of the P wave and the QRS complex.

QT Interval between the beginning of QRS complex and then end of T wave.

QTc Corrected QT taking into account the RR-interval.

QRSd QRS complex duration, from Qi until the J point.
Td T wave duration.

- Electric axis measurements (item 6 in Figure B):

P P-wave electric axis.
QRS QRS complex electric axis.
T T-wave electric axis.

4. BEAT COMPARISON SCREEN

This screen provides a tool to compare two heart beats. It will be disabled unless the resting and comparative beats have been selected from the monitoring screen in the ECG or ERGO programs. The user should:

1. Access the monitoring screen (Figure A) and begin the ECG signal acquisition.
2. Select icon  in the Tools Bar.
3. Click on the resting beat with the right button of the mouse.
4. Click on the comparative beat with the left button of the mouse.
5. The program will automatically access the standard measurement screen (Figure B).
6. Go to the beat comparison screen by clicking on the  icon (item 4 in figure C).

Once in the beat comparison screen both selected beats will be displayed, one on top of the other. The comparative beat is shown in color, so that the differences between them can be clearly visualized.

A measurement tool is provided to compare both beats. This tool inserts a point on the resting beat and another one on the comparative beat, and measures the time and amplitude differences between both of them.

Screen description:

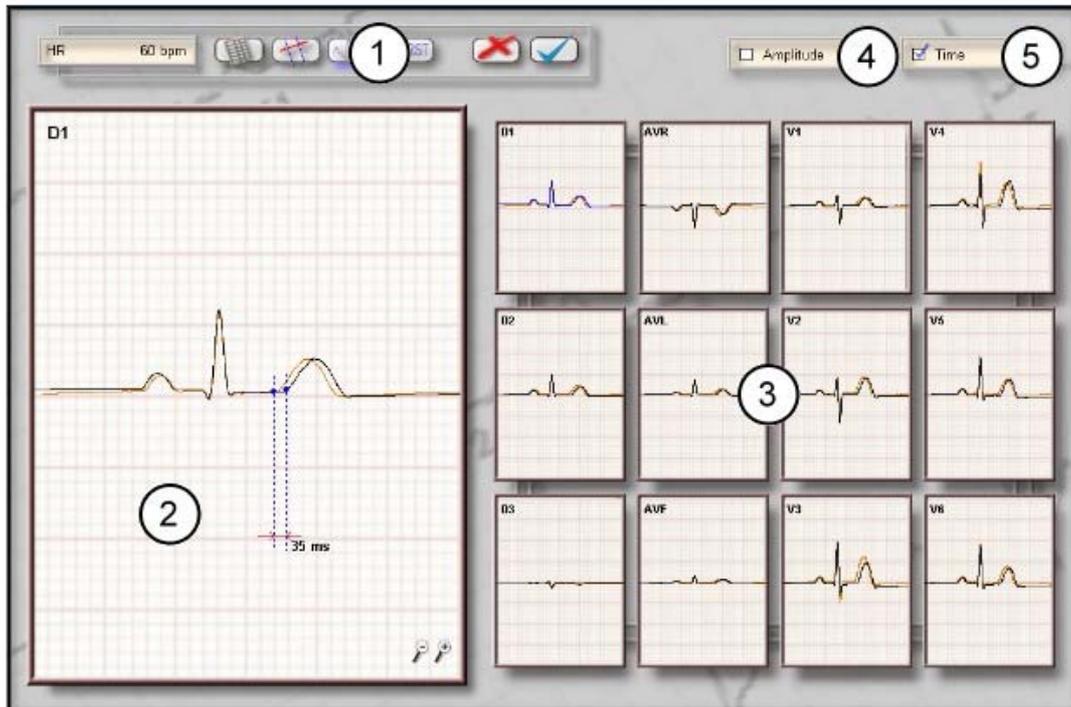


Figure E

- 1) Control bar.
- 2) Beat comparison visualization grid.
- 3) Lead selection.
- 4) Enable amplitude measurements.
- 5) Enable time interval measurements.

Operation instructions:

- **Lead selection:** Click on the lead you want to select with the left button of the mouse. The selected lead will be displayed in blue.
- **Move a characteristic point:** Select the point of interest in the beat comparison visualization grid (item 2 in Figure E) by clicking on it with the left button of the mouse. Then drag it to the desired position without releasing the left button of the mouse.
- **Move the ECG signal:** Click on the ECG signal with the right button of the mouse, and without releasing it, drag the signal to the desired position.
- **Zoom in / zoom out:** Click on the + and – zoom icon options with the left button of the mouse to increase or decrease the ECG signal amplitude.
- **Enable time and amplitude measurements:** In order to enable the graphic representation of amplitude and time intervals of the beats being compared (items 4 and 5 in figure E), click on the box next to each measurement with the left button of the mouse. The selected items will be marked as follows: .

5. MANUAL MEASUREMENT SCREEN

This screen allows performing measurements not considered in the standard measurement screen.

There are two measurement points located in the graphed signal. When willing to perform measurements between two given points, each of the measurement points should be located at the desired position of the cardiac cycle, and the program will automatically calculate the time interval and amplitude difference between those points.

Screen description:

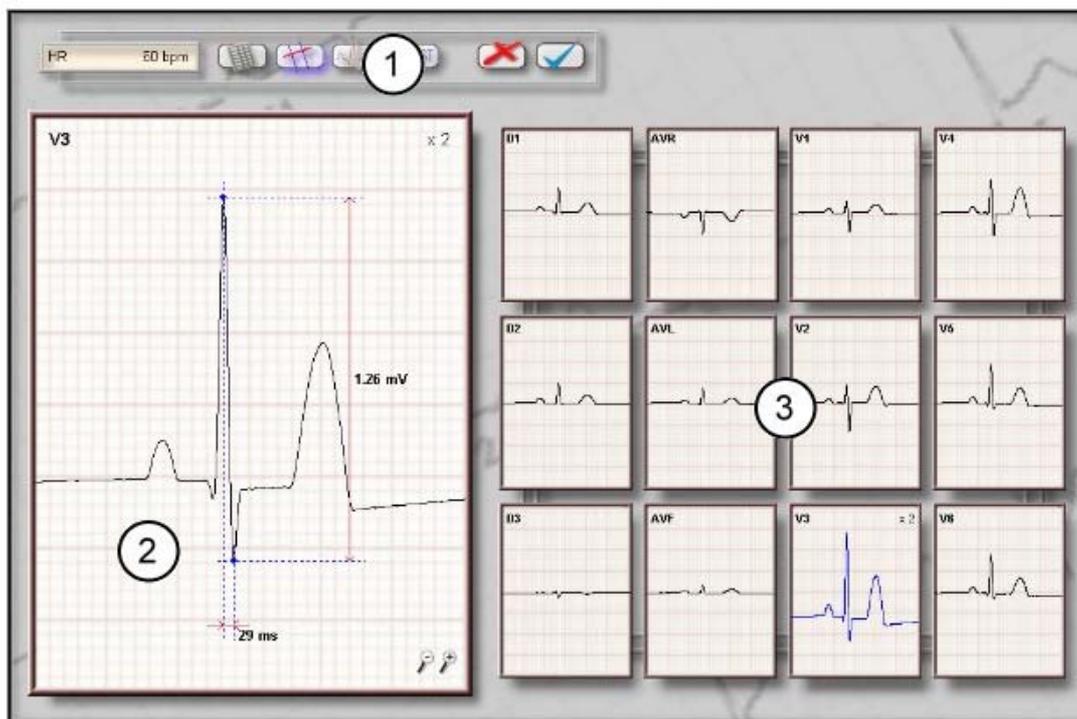


Figure F

- 1) Control bar.
- 2) Measurement visualization grid.
- 3) Lead selection.

Operation instructions:

They are the same explained in the previous section.

6. MEASUREMENT TABLE SCREEN

This screen consists of a table grouping all the values of the different measurements performed to all 12 leads. This allows the simultaneous visualization of all the information related to a particular heart beat.

Screen description:

| | D1 | D2 | D3 | AVR | AVL | AVF | V1 | V2 | V3 | V4 | V5 | V6 |
|-----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| P (mV) | 0.11 | 0.10 | -0.01 | -0.10 | 0.05 | 0.04 | 0.10 | 0.10 | 0.14 | 0.14 | 0.13 | 0.13 |
| Q (mV) | -0.07 | -0.04 | 0.03 | 0.05 | -0.05 | -0.03 | 0.00 | -0.02 | -0.05 | -0.04 | -0.06 | -0.07 |
| R (mV) | 0.54 | 0.41 | -0.10 | -0.49 | 0.22 | 0.17 | 0.25 | 0.40 | 0.36 | 0.79 | 0.77 | 0.68 |
| S (mV) | -0.04 | -0.04 | -0.00 | 0.04 | -0.02 | -0.02 | -0.32 | -0.49 | -0.26 | -0.41 | -0.14 | -0.13 |
| T (mV) | 0.21 | 0.19 | -0.03 | -0.20 | 0.12 | 0.09 | 0.19 | 0.35 | 0.46 | 0.57 | 0.25 | 0.25 |
| QRS (mV) | 0.61 | 0.45 | 0.13 | 0.64 | 0.27 | 0.19 | 0.57 | 0.86 | 1.23 | 1.20 | 0.90 | 1.01 |
| ST (mV) | -0.02 | -0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | -0.02 | -0.00 | -0.05 | -0.05 |
| ST slope (mV/s) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | -0.05 | -0.10 | -0.05 | 0.06 | 0.06 | 0.25 |
| Pd (ms) | 95.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.0 | 100.0 | 100.0 | 100.0 |
| QRSd (ms) | 95.0 | 95.0 | 96.0 | 95.0 | 116.0 | 88.0 | 96.0 | 96.0 | 105.0 | 95.0 | 95.0 | 95.0 |
| Td (ms) | 155.0 | 170.0 | 155.0 | 170.0 | 176.0 | 170.0 | 170.0 | 170.0 | 185.0 | 170.0 | 170.0 | 152.0 |
| HR (ms) | 1000.0 | 1007.0 | 1000.0 | 1000.0 | 850.0 | 1000.0 | 1000.0 | 1000.0 | 1003.0 | 1000.0 | 1007.0 | 1000.0 |
| T rms | 385.0 | 410.0 | 386.0 | 410.0 | 424.0 | 401.0 | 410.0 | 410.0 | 426.0 | 410.0 | 410.0 | 382.0 |
| Q1c (ms) | 385.0 | 406.6 | 300.0 | 410.0 | 426.5 | 401.0 | 410.0 | 410.0 | 425.4 | 410.0 | 400.6 | 382.0 |
| PR Seg. (ms) | 70.0 | 70.0 | 78.0 | 70.0 | 62.0 | 78.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 |
| PR Int. (ms) | 165.0 | 170.0 | 178.0 | 170.0 | 162.0 | 178.0 | 170.0 | 170.0 | 165.0 | 170.0 | 170.0 | 170.0 |

Figure G

- 1) Control bar
- 2) Measurement table
- 3) Selected measurement

Operation instructions:

- **Select a measurement:** When selecting a measurement, all the values for each of the leads will be displayed in bold for a clear visualization.