

Automatic Detection and Analysis of ECG Signals

The ADInstruments ECG Analysis Module for Chart software provides fast and powerful online or offline analysis of animal and human ECG signals. The MLS360 ECG Analysis Module for Chart for Windows is available separately or as part of Chart Pro.

Step 1: Detection of the ECG Waveform

Choose ECG Analysis > Settings

- Select the Whole Channel or a Selection of the signal for analysis
- Select an available Preset (If needed preset values may be modified to suit your experimental conditions)
- Choose one of the averaging options (For removal of noise)
- Select an available formula that calculates QTc

ECG Settings

Data source: ECG (dropdown) | Whole channel | Selection

Detection and Analysis settings: Preset: Rabbit (dropdown)

Averaging: Beats to average: 4 beats | Time to average: 10 s | Block averaging

QTc: Select: Bazett (dropdown)

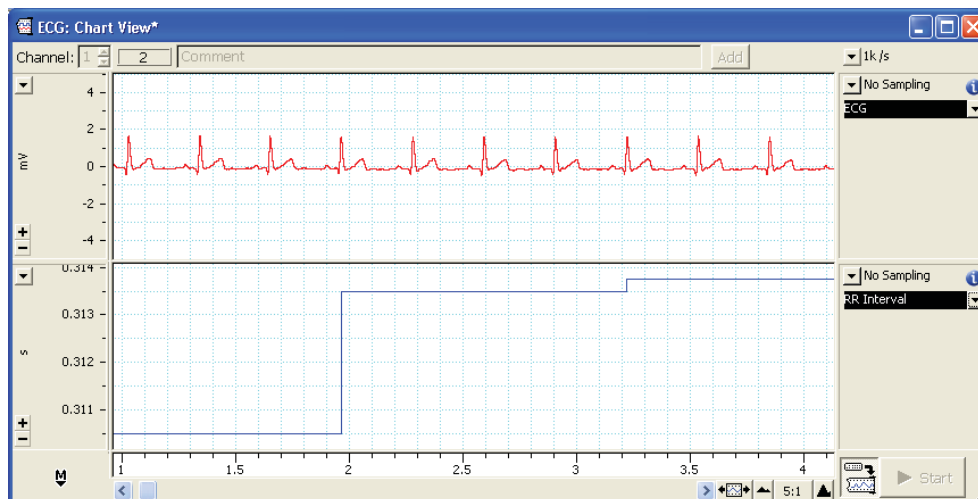
Detection: Typical QRS width is 35 ms | R waves are at least 200 ms apart | Alignment: QRS maximum (dropdown)

Analysis: Pre-P baseline 20 ms | Maximum PR 100 ms | Maximum RT 220 ms | Rodent T wave | Measure ST height at 50 ms from alignment

Buttons: OK, Cancel, Help

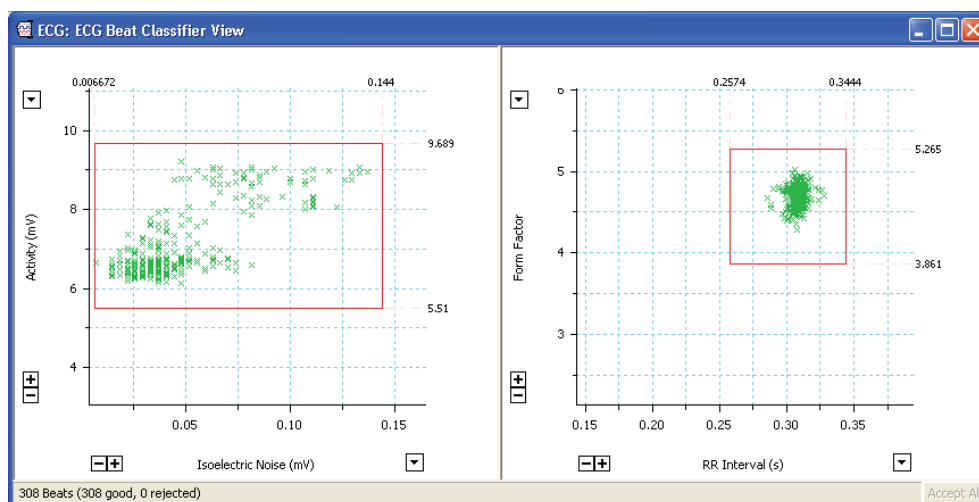
Step 2: View Analysis and Data Window

ECG Channel Calculations – this allows simultaneous display of any calculated ECG parameter of the averaged beats in a separate Chart Channel. Open a new channel in Setup > Channel Settings and select ECG Analysis from the new channel. Select the desired ECG parameter. You can display a variety of ECG parameters by opening more new channels.



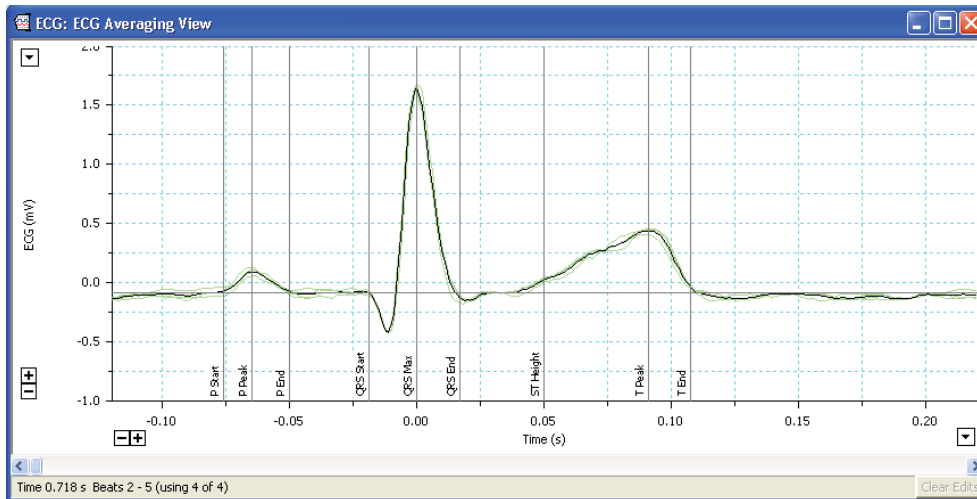
From the ECG Analysis menu select:

A. *ECG Beat Classifier* - enables the selection and removal of unsatisfactory beats or groups of beats. The left pane identifies beats with excessive 'noise' such as muscle activity. The pane on the right identifies beats with different RR intervals or altered QRS complexes. The edges of the red box represent the classification limits. To include or exclude detected beats in any analysis drag the limit edges with your cursor

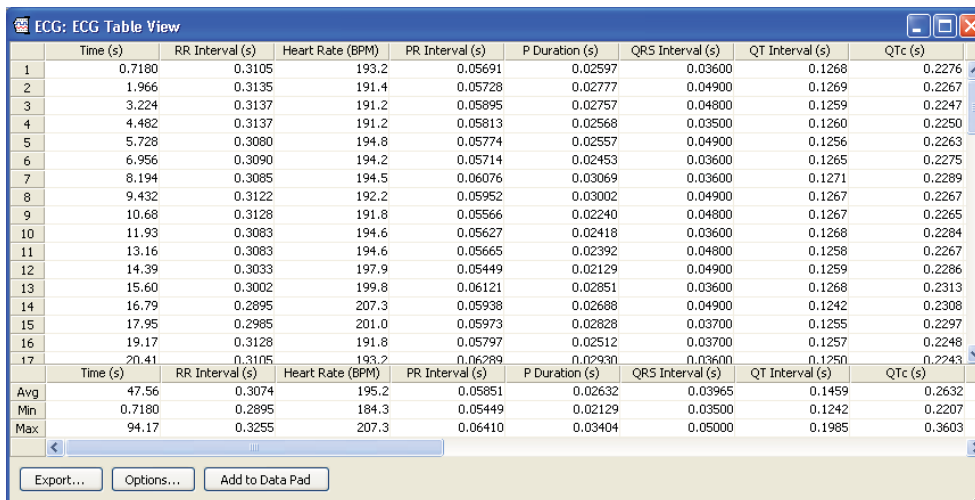


Automatic Detection and Analysis of ECG Signals

B. Averaging View – averaging may be useful in giving a more accurate representation of the ECG waveform in the presence of noise or movement artifacts, as well as comparing effects on the ECG before and after experimental intervention. You can view each average individually and all PQRST markers can be adjusted manually if required. A red marker indicates that it was edited manually. You can also clear all manual edits by pressing the 'Clear Edits' button.



C. ECG Table View - displays one row for each averaged beat. Any manual edits to markers in the Averaging View are displayed in red for the corresponding row in the ECG Table View. Rows are linked to the beats in the Averaging View so that highlighting a row will automatically show the corresponding averaged group, as well as these beats located within the Chart data file. You can add to the Data Pad (Chart's internal spreadsheet) or export the parameters to graphing or statistical programs for further analysis.

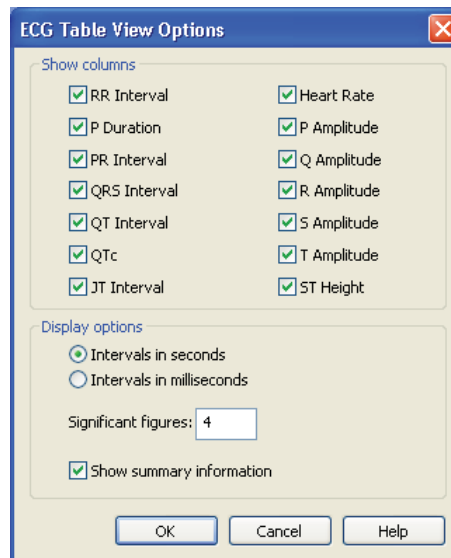


The figure shows a software window titled "ECG: ECG Table View". It displays a table with 17 rows of data for individual beats and summary statistics. The columns are: Time (s), RR Interval (s), Heart Rate (BPM), PR Interval (s), P Duration (s), QRS Interval (s), QT Interval (s), and QTc (s). The data is as follows:

	Time (s)	RR Interval (s)	Heart Rate (BPM)	PR Interval (s)	P Duration (s)	QRS Interval (s)	QT Interval (s)	QTc (s)
1	0.7180	0.3105	193.2	0.05691	0.02597	0.03600	0.1268	0.2276
2	1.966	0.3135	191.4	0.05728	0.02777	0.04900	0.1269	0.2267
3	3.224	0.3137	191.2	0.05895	0.02757	0.04800	0.1259	0.2247
4	4.482	0.3137	191.2	0.05813	0.02568	0.03500	0.1260	0.2250
5	5.728	0.3080	194.8	0.05774	0.02557	0.04900	0.1256	0.2263
6	6.956	0.3090	194.2	0.05714	0.02453	0.03600	0.1265	0.2275
7	8.194	0.3085	194.5	0.06076	0.03069	0.03600	0.1271	0.2289
8	9.432	0.3122	192.2	0.05952	0.03002	0.04900	0.1267	0.2267
9	10.68	0.3128	191.8	0.05566	0.02240	0.04800	0.1267	0.2265
10	11.93	0.3083	194.6	0.05627	0.02418	0.03600	0.1268	0.2284
11	13.16	0.3083	194.6	0.05665	0.02392	0.04800	0.1258	0.2267
12	14.39	0.3033	197.9	0.05449	0.02129	0.04900	0.1259	0.2286
13	15.60	0.3002	199.8	0.06121	0.02851	0.03600	0.1268	0.2313
14	16.79	0.2895	207.3	0.05938	0.02688	0.04900	0.1242	0.2308
15	17.95	0.2985	201.0	0.05973	0.02828	0.03700	0.1255	0.2297
16	19.17	0.3128	191.8	0.05797	0.02512	0.03700	0.1257	0.2248
17	20.41	0.3105	193.2	0.06289	0.02930	0.03600	0.1250	0.2243
Avg	47.56	0.3074	195.2	0.05851	0.02632	0.03965	0.1459	0.2632
Min	0.7180	0.2895	184.3	0.05449	0.02129	0.03500	0.1242	0.2207
Max	94.17	0.3255	207.3	0.06410	0.03404	0.05000	0.1985	0.3603

Buttons at the bottom include "Export...", "Options...", and "Add to Data Pad".

Select Options dialog to select parameters of interest that will be displayed in the ECG Table View



D. Analysis Plots – provides a variety of plots such as the QT vs Time Plot that shows the changes in QT with respect to time. You can also create Waterfall plots that provide a three dimensional representation of an ECG. You can enlarge, reduce and rotate the plot to your preferred viewing perspective.

