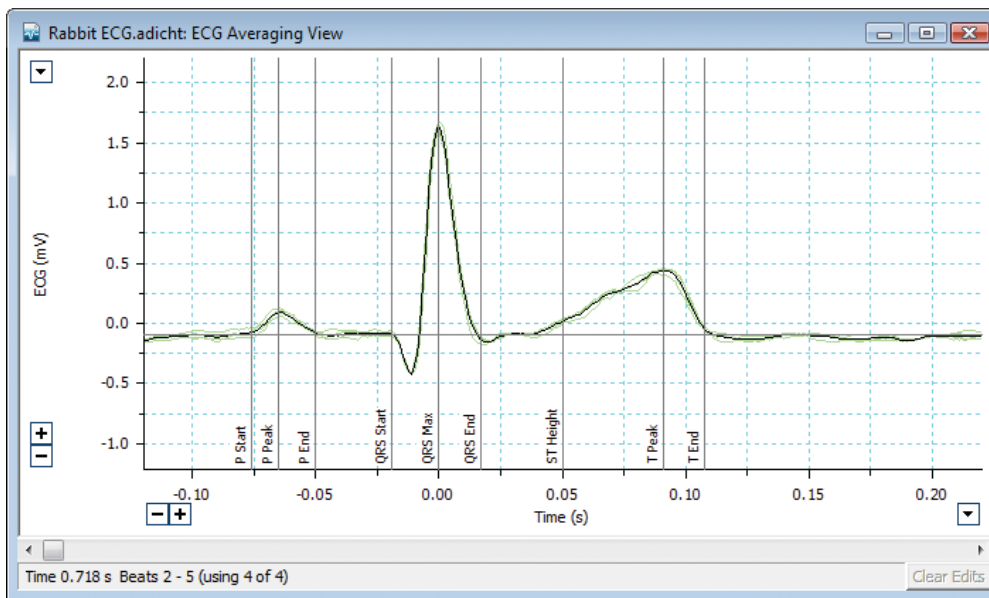


Electrocardiography

ECG Analysis Module for LabChart® & PowerLab®



Rabbit ECG showing PQRST components highlighted with markers. The averaged ECG signal is shown in black and the individual cycles that constitute the average are shown in green.

The ECG Analysis Module automatically detects PQRST onset, amplitude, and interval to assess heart function with default (species specific) or customized detection settings. The module's Beat Averaging feature reduces noise and movement artifact for easy data comparison before and after experimental intervention.

The module exports time, interval and amplitude data, as well as graphing:

- QT/RR
- QT/Time
- RR/Time
- Waterfall ECG

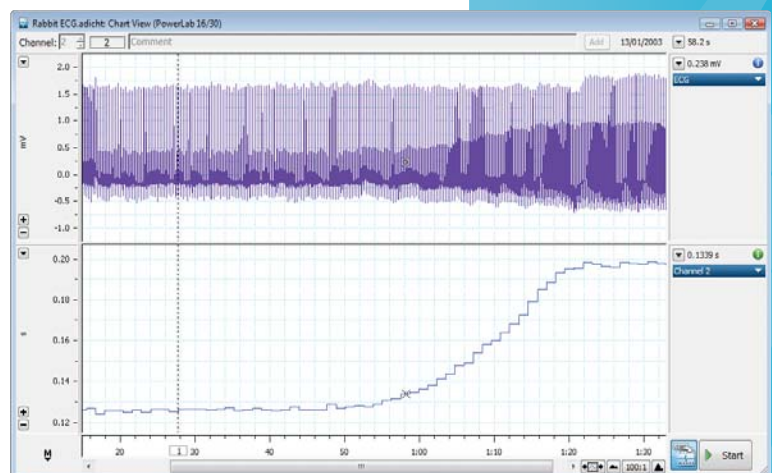
For further analysis, noise-contaminated and abnormal waveforms can be identified with the Beat Classifier, which also allows exclusion of unwanted individual beats.

When saved, the data remain unaltered by any calculations, ensuring the crude ECG can be reanalyzed at any time. ECG analysis settings can also be saved and recalled at any time using the Analysis Manager.

Features & Benefits

- Speeds up analysis of ECG data from humans, large and small animals
- Includes tailored algorithms for mouse and rat ECG analysis
- Allows real-time analysis of incoming ECG signals
- Features ECG Beat Classifier for detection of typical as well as atypical beats
- Provides tabular and graphical reports of start, end, amplitude and interval times of PQRST
- Allows averaging of any number of ECG beats

Below: LabChart ECG recording (top channel) with QT Interval (bottom channel) calculated in real time. Bottom channel illustrates QT prolongation following the addition of dofetilide.



ECG Analysis Module

Data Acquisition

ADInstruments PowerLab data acquisition systems include an analog-to-digital data acquisition unit and LabChart Pro software.

PowerLab data acquisition units are ideal for capturing cardiovascular biopotentials, with 16-bit resolution on all gain ranges, hardware filters that eliminate environmental interference, and sampling speeds of up to 200 kHz per channel. Provided with the PowerLab unit, LabChart Pro software is an intuitive interface for controlling hardware and transducers, data acquisition and display options, and automating repetitious procedures (such as channel calculations). LabChart Pro also provides specialized software modules for analyzing discrete data sets.

With LabChart Pro's ECG Analysis Module (provided), PowerLab data acquisition systems seamlessly detect and convert analog ECG to digital data, and provide a diverse range of powerful detection, measurement, display, analysis and extraction options.

ECG Settings

The ECG analysis Module analyzes real-time or saved ECG traces. For optimal acquisition and analysis of ECG, several default detection algorithms are available, which account for species-specific ECG cycle and beat ranges (such as S-T absence in rodents).

Default detection parameters are included for:

- Human
- Guinea pig
- Pig
- Rat
- Dog
- Mouse
- Rabbit

Detection settings can be created for other species, and default detection settings are completely customizable.

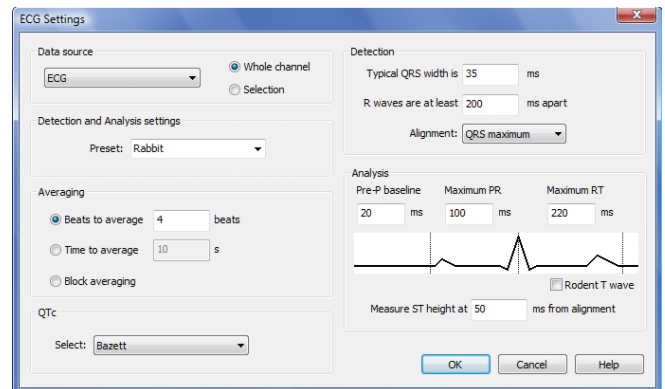
ECG Beat Classification

The Beat Classification tool categorizes beats according to activity and isoelectric noise, and presents them graphically for effortless identification of QRS complex and RR interval variance.

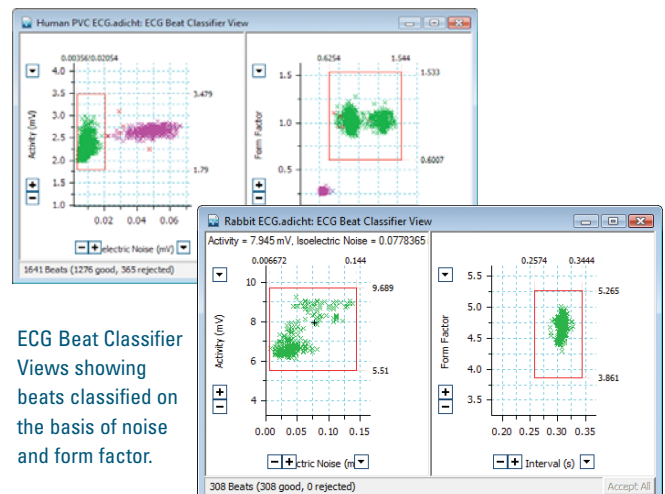
This easy to use tool allows rapid removal of artifact generated by movement, electrical interference and baseline drift, as well as exclusion of unwanted individual beats, such as extrasystole and supraventricular arrhythmias.



ECG Recorded using PowerLab data acquisition system and analyzed with ECG Analysis Module.



The ECG Settings dialog.



ECG Beat Classifier Views showing beats classified on the basis of noise and form factor.

ECG Analysis Module

ECG Averaging View

For easy comparison of ECG before and after experimental intervention, as well as additional removal of artifact, the Averaging View displays the mean PQRST trace from a selected data block.

Each averaged PQRST complex is automatically labelled (markers can be adjusted manually) and used to generate tabular data logs and graphs of individual and mean:

- Start times
- End times
- P, Q, R, S and T amplitudes
- PQRST interval times

ECG Table View

This tool calculates and records the parameters of each averaged ECG beat and logs them in tabular format for export to the Data Pad, or other graphing and statistical programs.

Calculate and export:

- RR Interval
- QTc
- PR Interval
- T Amplitude
- QT Interval
- P Amplitude
- QRS Interval
- R Amplitude

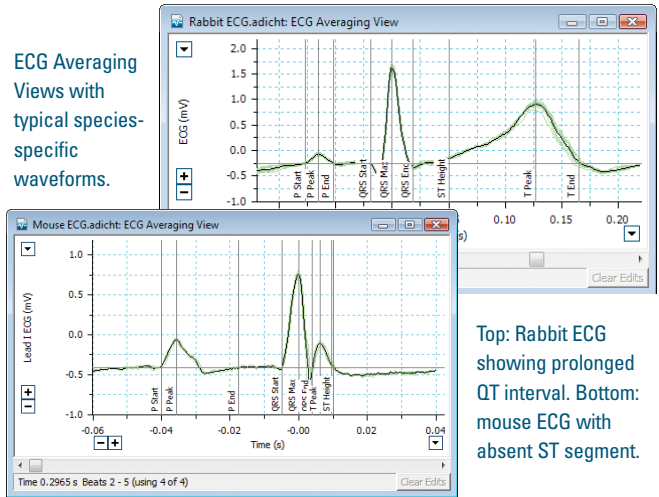
Analysis Plots

The ECG Module automatically extracts calculated data to generate a number of scatter plots for tractable presentation and post-hoc analysis. After selecting a data block of interest, generate one or all of the following:

- QT/RR Plot
(QT Interval vs. RR Interval)
- QT/Time Plot
(ideal for pharmacokinetics)
- RR/Time Plot
(indicates HR variance)
- Waterfall Plot
(3D waveform analysis)

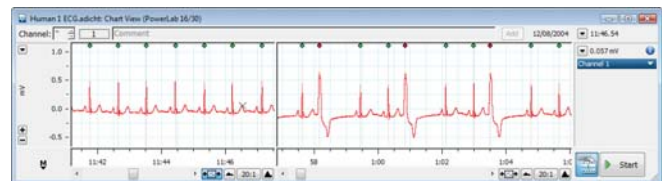
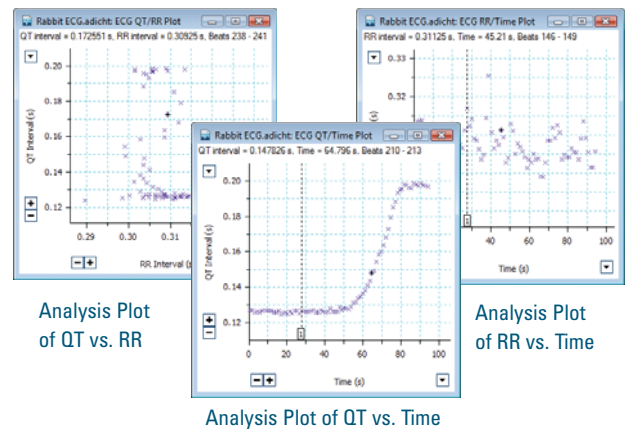
Expedient workflow

The Split Bar in Chart View (middle of screen right) allows simultaneous review of two different data blocks, live or offline. The Chart, Beat Classification, Table and Averaging Views are linked for swift and uncomplicated navigation to data points of interest, with easily perceptible manual/user data edits marked in red.



Time (s)	RR Interval (s)	Heart Rate (bpm)	PR Interval (s)	P Duration (s)	QRS Interval (s)	QT Interval (s)	QTc (s)	JT Interval (s)	P Amplitude (mV)	R Amplitude (mV)		
1	0.718	83.6	0.0591	0.0297	0.0360	0.1268	0.2276	0.0902	0.1768	-0.3238	1.779	
2	1.966	0.3139	191.4	0.05728	0.02777	0.04000	0.1269	0.2267	0.07790	0.1771	-0.3096	1.724
3	2.224	0.3128	191.2	0.05995	0.02717	0.04000	0.1269	0.2247	0.07783	0.1744	-0.3044	1.739
4	4.462	0.3137	191.2	0.05813	0.02568	0.03000	0.1260	0.2202	0.09302	0.1889	-0.3219	1.771
5	3.729	0.3080	194.8	0.05774	0.02517	0.04000	0.1236	0.2263	0.07958	0.1583	-0.3019	1.687
6	8.956	0.3090	194.2	0.05714	0.02463	0.03000	0.1265	0.2275	0.09045	0.1611	-0.3244	1.742
7	8.194	0.3085	194.5	0.06076	0.03069	0.03000	0.1271	0.2289	0.09111	0.1625	-0.2980	1.729
8	9.432	0.3122	192.2	0.05952	0.03002	0.04000	0.1267	0.2267	0.07765	0.1725	-0.3163	1.712
9	20.683	0.3127	191.8	0.05966	0.02240	0.04000	0.1267	0.2265	0.07968	0.1706	-0.3219	1.712
10	11.928	0.3083	194.6	0.05627	0.02418	0.03000	0.1268	0.2284	0.09079	0.1762	-0.3162	1.732
11	11.139	0.3082	194.6	0.05660	0.02292	0.04000	0.1258	0.2267	0.07785	0.1663	-0.3141	1.718
12	14.394	0.3031	197.9	0.05448	0.02129	0.04000	0.1258	0.2266	0.07969	0.2031	-0.3275	1.827
13	15.399	0.3003	198.8	0.06121	0.02851	0.03000	0.1268	0.2313	0.09075	0.2000	-0.3011	1.766
14	26.794	0.2995	207.3	0.05938	0.02688	0.04000	0.1242	0.2268	0.07517	0.1881	-0.3152	1.766
15	17.946	0.2985	201.0	0.05973	0.02828	0.03700	0.1255	0.2297	0.08847	0.1637	-0.3056	1.790
16	19.367	0.3127	191.8	0.05797	0.02513	0.03700	0.1237	0.2248	0.08870	0.1891	-0.2963	1.736
17	20.413	0.3105	193.2	0.06289	0.02930	0.03000	0.1250	0.2243	0.08951	0.1628	-0.2947	1.750
18	21.656	0.3095	195.9	0.05701	0.02438	0.03700	0.1261	0.2267	0.08930	0.1700	-0.3075	1.749
Avg	0.3074	195.3	0.05911	0.02632	0.03965	0.1409	0.2632	0.1061	0.1814	-0.3061	1.818	
Min	0.2895	184.3	0.05449	0.02129	0.03000	0.1242	0.2207	0.07517	0.1583	-0.3487	1.687	
Max	0.3255	207.3	0.06420	0.03404	0.05000	0.1365	0.2363	0.10225	0.2119	-0.2709	2.199	
Count	77	77	66	66	66	66	77	77	66	77	77	

ECG Table View. With a click of a button, table contents can be exported and opened in a number of graphical or statistical analysis programs.

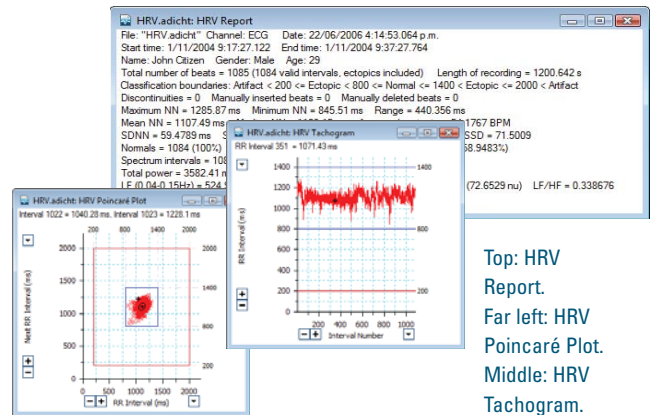


Additional Software

Heart Rate Variability Module

Also included with LabChart Pro, the HRV Module's R-wave threshold detector identifies and calculates ECG beat-to-beat interval variation to automatically categorize beats as normal, ectopic, or artifact (can also be used with arterial pulse signal).

The automatic classification feature can be manually overridden to reclassify beats, or remove noise and individual ectopic beats. R-R data can be averaged and/or exported graphically as Poincaré and tachogram plots, and period and ΔNN histograms, which can then be used for power frequency analysis in LabChart Spectrum View.



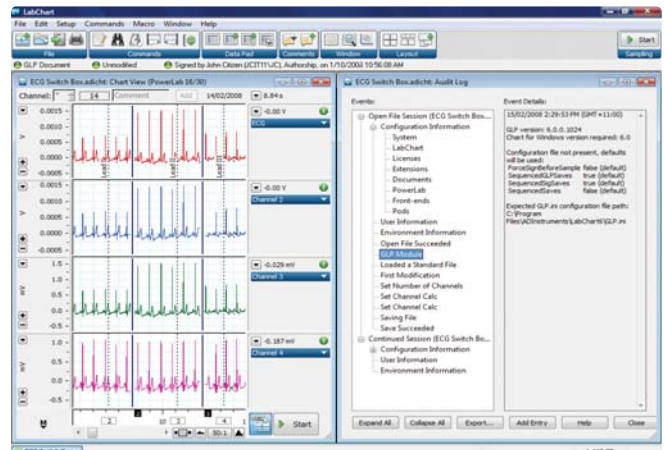
Top: HRV Report.
Far left: HRV Poincaré Plot.
Middle: HRV Tachogram.

GLP for PowerLab Systems

For those working in GLP and FDA 21 CFR Part 11 environments, the GLP Client and GLP Server provide the required user interface, audit trail and signing components for validation of data.

In conjunction with PowerLab data acquisition systems, the GLP Client and GLP Server provide:

- Securely signed data files to proscribe tampering
- Fixed audit trail recording operations
- Preservation of raw data
- Date and time stamping
- Visual indication of file validity
- Centralized authorization and user validation



The GLP Client adds a GLP Status Bar to the LabChart application window and an Audit Log (right panel) that records the user, GLP status, configuration and recorded data information.

Ordering Information

Software

MLS060/7 LabChart

MLS330/7 GLP Client and MLS335 GLP Server

MLS260/7 LabChart Pro

(Includes the modules listed below. Modules are also available for individual purchase.)

MLS390/7 Dose Response	(Win)	MLS310/7 Heart Rate Variability	(Win and Mac)	MLS340/7 Cardiac Output	(Win)
MLS065/7 DMT Normalization	(Win and Mac)	MLS240/7 Metabolic	(Win and Mac)	MLS320/7 Video Capture	(Win and Mac)
MLS370/7 Blood Pressure	(Win)	MLS062/7 Spike Histogram	(Win and Mac)	MLS395/7 Circadian Analysis	(Win)
MLS360/7 ECG Analysis	(Win)	MLS380/7 Peak Analysis	(Win)	MLS375/7 PV Loop	(Win)

 Share your data with colleagues. Free LabChart Reader – download to view and analyze LabChart data.

PowerLab, MacLab, LabChart, LabTutor and LabAuthor are registered trademarks and Chart and Scope are trademarks of ADInstruments Pty Ltd. All other trademarks are the property of their respective owners EC09/11

PowerLab systems and signal conditioners meet the European EMC directive. ADInstruments signal conditioners for human use are approved to the IEC60601-1 patient safety standard and meet the CSA C22.2 No. 601.1-M90 and UL Std No. 2601-1 safety of medical electrical equipment standards.



ADINSTRUMENTS.com

North America

Tel: +1 888 965 6040
Fax: +1 866 965 9293
info.a@adstruments.com

United Kingdom

Tel: +44 1865 332 050
Fax: +44 1865 332 051
info.uk@adstruments.com

Germany

Tel: +49 6226 970105
Fax: +49 6226 970106
info.de@adstruments.com

North Asia

Tel: +86 21 5830 5639
Fax: +86 21 5830 5640
info.cn@adstruments.com

South East Asia

Tel: +60 3 8024 5296
Fax: +60 3 8023 6307
info.sea@adstruments.com

Japan

Tel: +81 52 932 6462
Fax: +81 52 932 6755
info.jp@adstruments.com

South America

Tel: +56 2 356 6749
Fax: +56 2 356 6786
info.cl@adstruments.com

Brazil

Tel: +55 11 3266 2393
Fax: +55 11 3266 2392
info.br@adstruments.com

South Asia

Tel: +91 11 4306 5615
Fax: +91 11 4306 5614
info.in@adstruments.com

Australia

Tel: +61 2 8818 3400
Fax: +61 2 8818 3499
info.au@adstruments.com

New Zealand

Tel: +64 3 477 4646
Fax: +64 3 477 4346
info.nz@adstruments.com

Head Office

Tel: +61 2 8818 3400
Fax: +61 2 8818 3499
info.au@adstruments.com

ISO 9001:2008 Certified Quality Management System

