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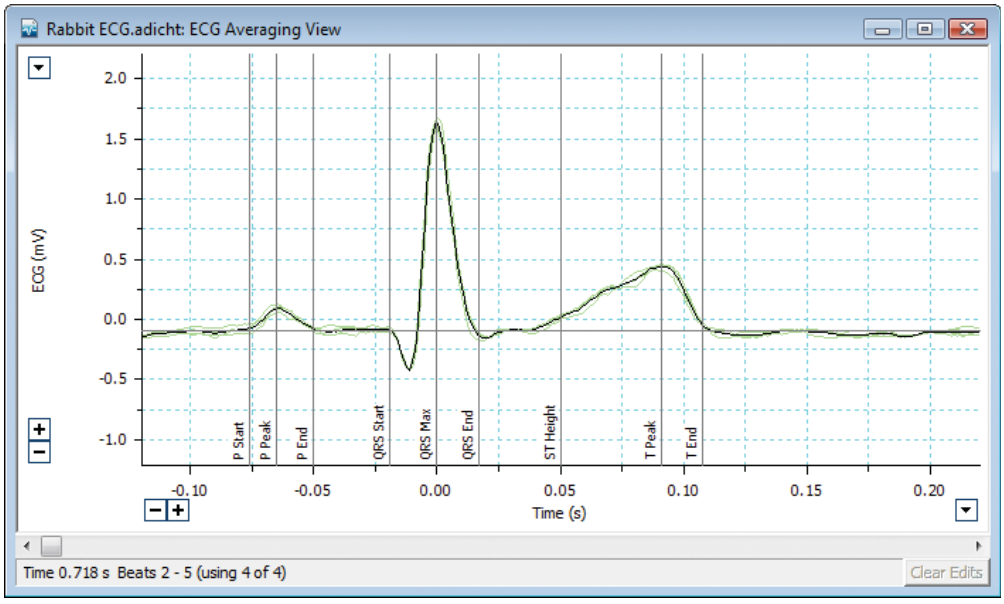
Electrocardiography

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:

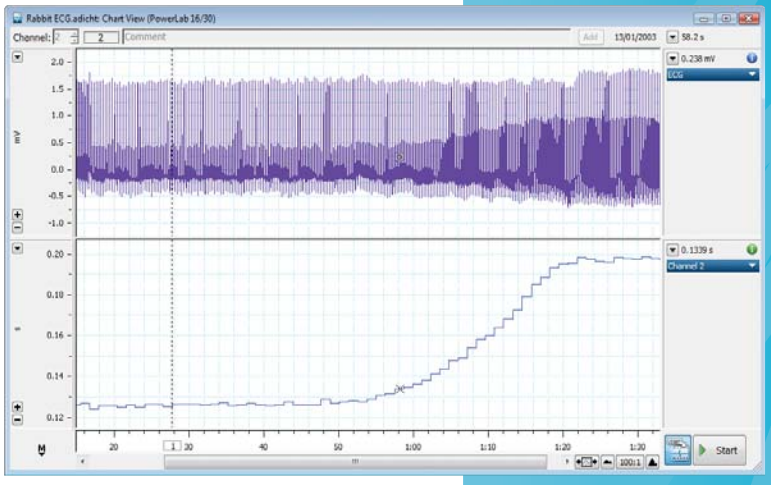
- QT/RR
- QT/Time
- RR/Time
- Waterfall ECG

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.

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

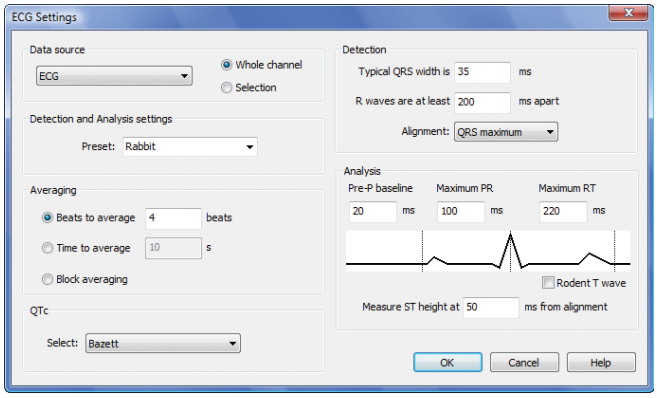
ECG Settings

The ECG analysis Module analyzes real-time or saved ECG traces. For optimal acqusition 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
- Pig
- Dog
- Rabbit
- Guinea pig
- Rat
- Mouse

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

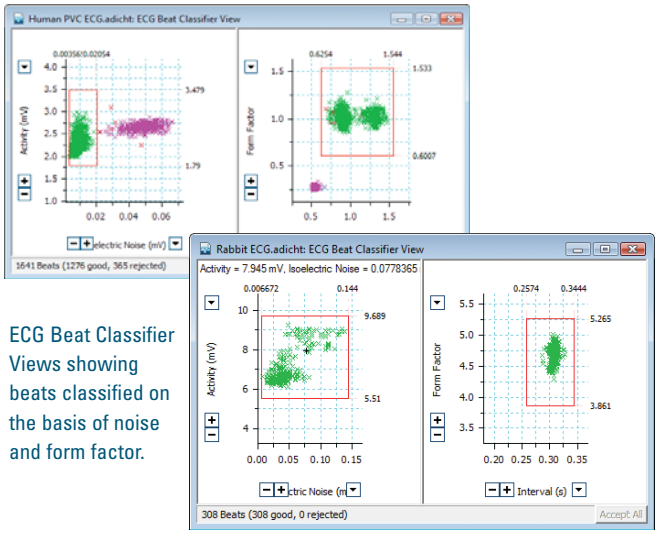


The ECG Settings dialog.

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

ECG Analysis Module

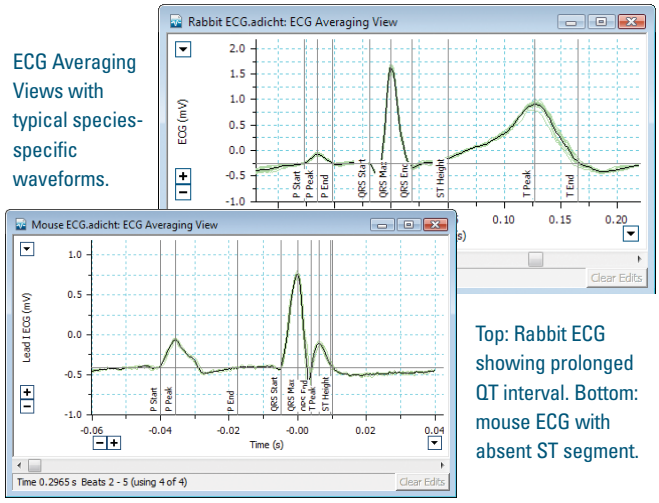
ECG Averaging View

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 Averaging Views with typical species-specific waveforms.



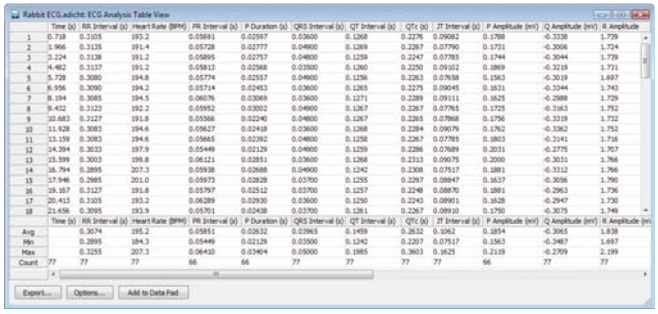
Top: Rabbit ECG showing prolonged QT interval. Bottom: mouse ECG with absent ST segment.

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

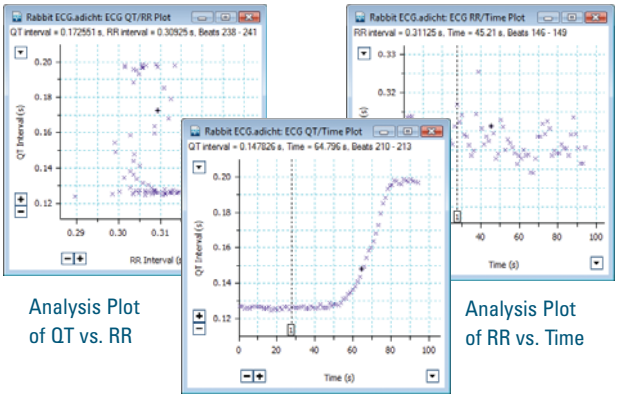


ECG Table View. With a click of a button, table contents can be exported and opened in a number of graphical or statistical analysis programs.

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)



Analysis Plot of QT vs. RR

Analysis Plot of RR vs. Time

Analysis Plot of QT vs. Time

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.

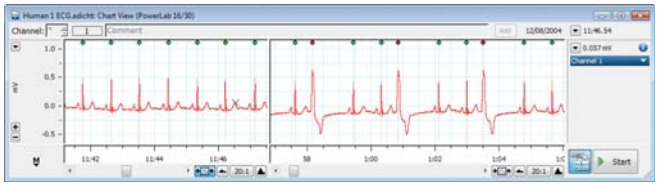


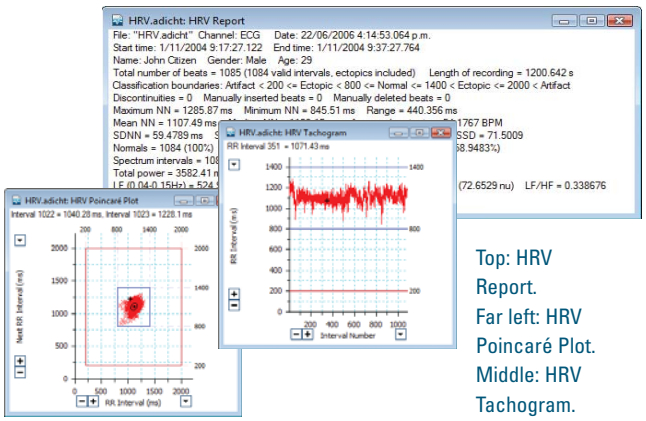
Chart View shows detected ECG beat markers. Extrasystole visible at right.

Additional Software

Heart Rate Variability (HRV) Module

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.



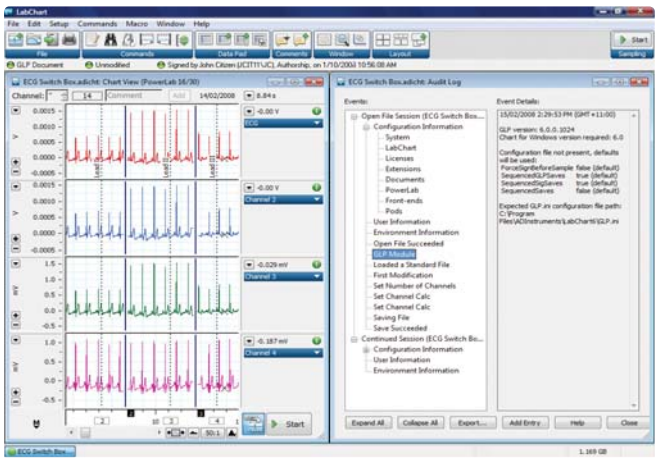
Top: HRV Report. Far left: HRV Poincaré Plot. Middle: HRV Tachogram.

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.

Used 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.

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