



European Regulatory Manager
Welch Allyn Ltd.
Navan Business Park
Dublin Road
Navan, County Meath,
Republic of Ireland
Tel.: +353 46 90 67700
Fax: +353 46 90 67754



Welch Allyn
4341 State Street Road
Skaneateles Falls, NY
13153-0220 USA
www.welchallyn.com





US Federal law restricts this device to sale by or on the order of a physician.

Copyright

© Copyright 2010, Welch Allyn. All rights are reserved. No one is permitted to translate, reproduce or duplicate this manual or any part thereof, in any form, without prior written permission from Welch Allyn. Welch Allyn assumes no responsibility for any injury to anyone, or for any illegal or improper use of the product, that may result from failure to use this product in accordance with the instructions, cautions, warnings, or statement of intended use published in this manual. Unauthorized copying of this publication may not only infringe copyright but also reduce the ability of Welch Allyn to provide accurate and up-to-date information to users and operators alike.

Welch Allyn®, CardioPerfect® Workstation and SpiroPerfect® are registered trademarks of Welch Allyn.

Software in this product is Copyright 2008, Welch Allyn. All rights are reserved. The software is protected by United States of America copyright laws and international treaty provisions applicable worldwide. Under such laws, the licensee is entitled to use the copy of the software provided on the original distribution medium. The software may not be copied, decompiled, reverse-engineered, disassembled or otherwise reduced to human-perceivable form. This is not a sale of the software or any copy of the software; all right, title and ownership of the software remains with Welch Allyn.

The information contained in this manual is subject to change without notice.
All changes will be in compliance with regulations governing manufacture of medical equipment.

User responsibility

This product is designed to perform in conformity with the description thereof contained in this manual and accompanying labels and inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. A defective product should not be used. Parts that are broken, plainly worn, missing or incomplete, distorted or contaminated should be replaced immediately. Should any repair or replacement become necessary, we recommend that service be performed at the nearest approved service center. The user of the product shall have the sole responsibility for any malfunction, which results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than Welch Allyn or their authorized service personnel.

Accessories

The Welch Allyn warranty can only be honored if you use Welch Allyn approved accessories and replacement parts.

**Caution**

Use of accessories other than those recommended by Welch Allyn may compromise product performance.

Warranty, Service, and Spare Parts**Warranty**

All repairs on products under warranty must be performed or approved by Welch Allyn. Unauthorized repairs will void the warranty. In addition, whether or not covered under warranty, any product repair shall exclusively be performed by Welch Allyn certified service personnel.

Assistance and Parts

If the product fails to function properly or if assistance, service, or spare parts are required, contact the nearest Welch Allyn Technical Support Center.

USA	1-800-535-6663	Canada	1-800-561-8797
Latin America	(+1) 305-669-9003	South Africa	(+27) 11-777-7555
European Call Center	(+353) 46-90-67790	Australia	(+61) 2-9638-3000
United Kingdom	(+44) 207-365-6780	Singapore	(+65) 6419-8100
France	(+33) 1-55-69-58-49	Japan	(+81) 3-6383-0852
Germany	(+49) 695-098-5132	China	(+86) 21-6327-9631

Before contacting Welch Allyn it is helpful to attempt to duplicate the problem and to check all accessories to ensure that they are not the cause of the problem.

When calling, please be prepared to provide:

- Product name and model number and complete description of the problem
- The serial number of your product (if applicable)
- The complete name, address and phone number of your facility
- For out-of-warranty repairs or spare parts orders, a purchase order (or credit card) number
- For parts order, the required spare or replacement part number(s)

Repairs

If your product requires warranty, extended warranty, or non-warranty repair service, please call first the nearest Welch Allyn Technical Support Center. A representative will assist you troubleshooting the problem and will make every effort to solve it over the phone, avoiding potential unnecessary return.

In case the return cannot be avoided, the representative will record all necessary information and will provide a Return Material Authorization (RMA) number, as well as the appropriate return address. A Return Material Authorization (RMA) number must be obtained prior to any return.

Note

Welch Allyn does not accept returned products without an RMA.

Packing Instructions

If you have to return goods for service, follow these recommended packing instructions:

- Remove all hoses, cables, sensors, power cords, and ancillary products (as appropriate) before packing, unless you suspect they are associated with the problem.
- Wherever possible use the original shipping carton and packing materials.
- Include a packing list and the Welch Allyn Return Material Authorization (RMA) number.

It is recommended that all returned goods be insured. Claims for loss or damage to the product must be initiated by the sender.

Limited Warranty Statement

Welch Allyn, Inc. warrants that the Welch Allyn CardioPerfect Workstation computer based product you have purchased meets the labeled specifications of the Product and will be free from defects in materials and workmanship that occur within 1 year after the date of purchase. Accessories used with the Product are warranted for 90 days after the date of purchase.

The date of purchase is: 1) the date specified in our records, if you purchased the Product directly from us, 2) the date specified in the warranty registration card that we ask you to send to us, or 3) if you don't return the warranty registration card, 120 days after the date on which the Product was sold to the dealer from whom you bought the Product, as documented in our records.

This warranty does not cover damage caused by: 1) handling during shipping, 2) use or maintenance contrary to labeled instructions, 3) alteration or repair by anyone not authorized by Welch Allyn, and 4) accidents.

If a Product or accessory covered by this warranty is determined to be defective because of defective materials, components, or workmanship, and the warranty claim is made within the warranty period described above, Welch Allyn will, at its discretion, repair or replace the defective Product or accessory free of charge.

You must obtain a return authorization from Welch Allyn to return your Product before you send it to Welch Allyn's designated service center for repair.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. WELCH ALLYN'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF PRODUCTS CONTAINING A DEFECT. WELCH ALLYN IS NOT RESPONSIBLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM A PRODUCT DEFECT COVERED BY THE WARRANTY.



The CardioPerfect devices are an integral part of a personal computer based diagnostic system. The user shall adhere to warnings in order to ensure safe and reliable performance of the system.

- The personal computer (non-medical electrical equipment) shall be situated outside the patient environment (reference IEC 60601-1-1).
- The personal computer used should be approved to the appropriate safety standard for non-medical electrical equipment (IEC 60950, or its national variants), and use of an isolation transformer is recommended.

If there is a requirement for the personal computer to be situated within the patient environment it is the responsibility of the user to ensure the system provides a level of safety that ensures compliance with IEC 60601-1.

Table of Contents

1. GETTING STARTED	8
1.1. The Welch Allyn CardioPerfect resting ECG window	8
2. RECORDING ECGS	10
2.1. Record an ECG	10
2.2. Place electrodes on the patient	10
2.3. Create a new ECG	12
2.4. Select how you want to view leads.....	13
2.5. Set a rhythm strip	13
2.6. Turn pacemaker on and off	13
2.7. Apply an AC filter.....	13
2.8. Apply a muscle noise filter.....	14
2.9. Record an ECG	14
2.10. Recording rhythm ECGs	14
2.11. Cancel a recording	15
2.12. Pacemaker pulse detection	15
2.13. Signal quality indication	16
3. RECORDING ECGS FOR PEDIATRIC PATIENTS.....	18
4. VIEWING ECGS.....	20
4.1. View and edit ECG information	20
4.2. Views.....	21
4.3. Parameters.....	24
4.4. QTc.....	24
4.5. QT dispersion (optional)	25
4.6. Working with views.....	26
4.7. Zoom in and out on an ECG.....	26
4.8. Set chart speed and sensitivity.....	27
4.9. View one single complex or loop	27
4.10. Turn pacemaker on and off	27
4.11. Apply muscle noise filter.....	27
4.12. Apply AC filter.....	28
4.13. Apply baseline filter	28
4.14. Apply anti-aliasing	28
4.15. Make measurements.....	29
4.16. Compare ECGs.....	29
4.17. Display markers.....	30
5. INTERPRETING ECGS.....	31
5.1. About MEANS and PEDMEANS interpretation software	31
5.2. Edit and confirm an interpretation	31
5.3. View interpretation history	33
5.4. Reanalyze an ECG.....	33
6. PRINTING ECGS	34
6.1. Print an ECG	34

6.2.	Automatically print an ECG	34
7.	MAINTAINING THE RECORDER	35
7.1.	Cleaning the Patient cables and PC interface cables	35
7.2.	Replace the battery of the recorder	35
8.	CUSTOMIZING THE RESTING ECG SOFTWARE	39
8.1.	General tab	39
8.2.	Viewing tab	40
8.3.	Printing tab	40
8.4.	QT dispersion tab	41
8.5.	Recorder Tab	42
8.6.	Customize ecg.txt	42
9.	TROUBLESHOOTING	43
10.	FUNCTION KEYS	45
11.	BEFORE INSTALLING THE RESTING ECG SOFTWARE	46
11.1.	Structure	46
12.	INSTALLING THE RESTING ECG MODULE	47
12.1.	Connecting the RS232 interface	47
12.2.	Connecting the USB interface	47
12.3.	Install the PCI CPCOM card	48
12.4.	Install the PCMCIA CPCOM Card	49
13.	SAFETY AND PRECAUTIONS	50

Welcome

Welcome to Welch Allyn CardioPerfect Resting ECG, a module of Welch Allyn CardioPerfect Workstation.

With the Welch Allyn CardioPerfect Resting ECG Module, you can record, view and interpret resting ECGs. You can also use it to print ECGs in various formats.

This manual contains specific information about the Resting ECG Module of Welch Allyn CardioPerfect Workstation. For all general information about the workstation software please refer to the Workstation manual, this includes:

- Creating and editing Patient cards
- General information about printing

For further information on installation and configuration please refer to the Installation manual. Detailed information on servicing is described in the Service and Advanced Installation manual.

Intended use

Using the optional ECG module and associated accessories, the user can acquire, view, store, and print ECG waveforms. The ECG module also provides optional algorithms (MEANS) to generate measurements, data presentations, graphical presentations, and interpretive statements on an advisory basis. These are presented for review and interpretation by the clinician.

Indications

Indications for electrocardiography range from routine screening of cardiac health in the physician office environment to directed diagnostic differentiation in a hospital cardiology department.

Contraindications

There are no known contraindications for the recording of a resting ECG.

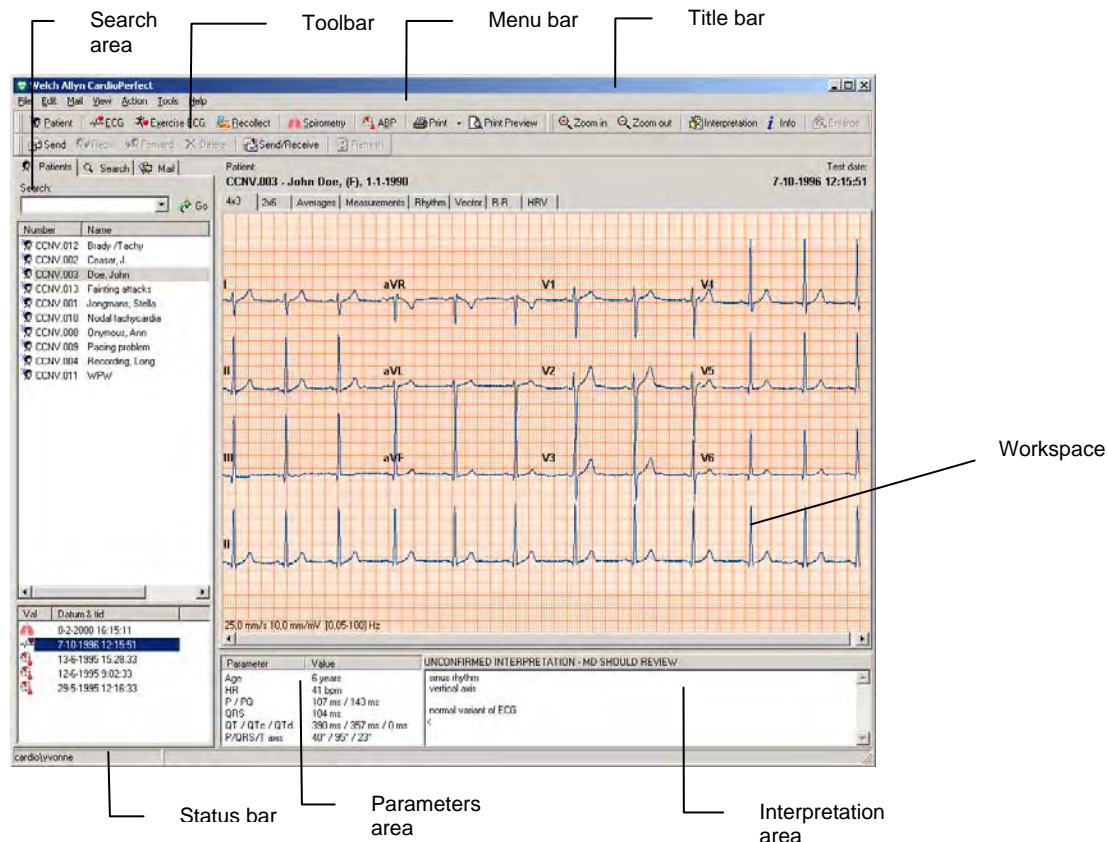
Due to summation of leakage currents, it is possibly hazardous to connect several devices to the patient simultaneously.

<p>Important: A computer generated interpretation cannot replace sound medical reasoning by a trained professional. Therefore, a physician should always review the interpretation.</p>
--

1. Getting started

1.1. The Welch Allyn CardioPerfect resting ECG window

This section will guide you around the various parts of Welch Allyn CardioPerfect Resting ECG module.



Title bar The title bar displays the name of the program. The title bar contains three buttons that you can use to maximize, minimize and close the Workstation window.

Menu bar Each menu in the menu bar contains a number of tasks that you can perform with Welch Allyn CardioPerfect. Sometimes, menus are gray. This means that you cannot access that functionality at that particular point, either because it is not available, or because you are not authorized to use it. Each module has its own menu bar.

Tool bar The tool bar contains buttons that give you easy access to the most common tasks in Welch Allyn CardioPerfect.

Search area The search area contains search and display functionality that lets you easily retrieve patients and tests. In the search area, you can find a patient, see which tests were recorded for that patient and see the kind of tests that were recorded. You can also create search patterns, an easy way of finding information that you

need frequently.

Workspace	The workspace is the core part of Welch Allyn CardioPerfect. It displays the ECG in various formats. These formats, also called views, are each displayed on a separate tab. The workspace is the place where you view, compare and measure ECGs.
Parameters area	The parameters area contains some details of the ECG, such as the age and the heart rate of the patient, and the global measurements for the ECG (P duration, QRS duration, PQ duration, QT duration, corrected QT duration, P-axis, QRS-axis, T-axis and QTd or JTd duration).
Interpretation area	The Interpretation area contains the interpretation (either entered by the physician or generated by MEANS software). It displays the interpretation text and whether the interpretation has been confirmed.
Shortcut menu	In the workspace, you can use shortcut menus to access the most common tasks. You can access these by clicking on the workspace with your right mouse button.
Status bar	The status bar displays the name of the user that is currently logged on to Welch Allyn CardioPerfect.

2. Recording ECGs

2.1. Record an ECG

Welch Allyn CardioPerfect records ECGs fast, easily and reliably. The only thing you have to do is make sure the electrodes are placed correctly and switch on the recorder. Welch Allyn CardioPerfect takes care of recording, making a number of measurements and calculations, saving the recording and providing a first interpretation.

To record an ECG, you need to follow these global steps. Each step is explained in more detail on the following pages.

1. Place electrodes on the patient.
2. Select or create a patient.
3. Create a new ECG. The Real-time monitor is displayed.
4. Switch on the recorder. If a PRO recorder with USB cable is used no message will appear, the recorder will be switched on automatically. The Real-time monitor displays the ECG traces.
5. Select how you want to see leads and set a rhythm strip.
6. If necessary, apply an AC filter to remove possible noise that is due to AC mains interference.
7. In the Real-time monitor, wait until the signal is stabilized and click the **Record** button to start recording. The progress of the recording is shown in the gauge at the bottom of the window.
8. When the recording is finished, Welch Allyn CardioPerfect will ask you to switch off the recorder. If a Pro recorder with USB connection is used the recorder will be switched off automatically, no message appears. Welch Allyn CardioPerfect automatically saves the ECG and calculates the averaged complexes.
9. Disconnect the patient. The recorded ECG is automatically displayed.

2.2. Place electrodes on the patient

Important: Because Welch Allyn CardioPerfect is a 12 lead electrocardiograph all electrodes must be connected! Proper skin preparation (abrasion if necessary) and proper electrodes are very important for a good signal quality.

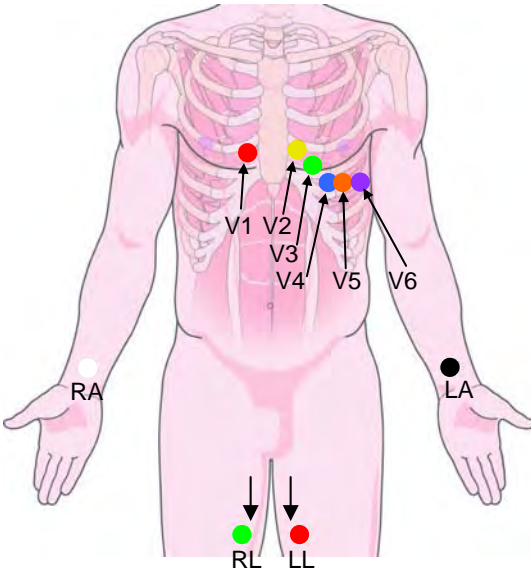
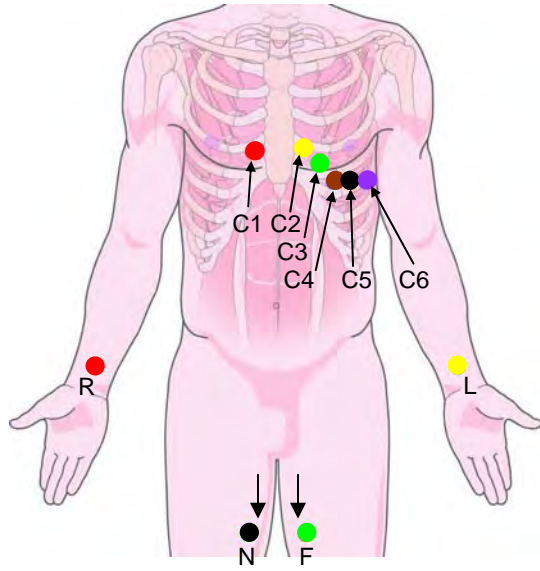
Important: When you connect the electrodes to the patient, make sure that the electrodes and their connectors (also the RL/N electrode) do not contact other conducting parts (including earth).

Extremity electrodes

The electrodes may be placed on any part of the arms or the legs as long as they are below the shoulders in the former and below the inguinal fold anteriorly and the gluteal fold posteriorly in the latter. Any other placement necessary by deformed or missing extremities must be noted on the record.

Precordial electrodes

Connect the precordial electrodes in the following positions:

AHA		IEC
		
V1	Fourth intercostal space at the right border of the sternum.	C1
V2	Fourth intercostal space at the left border of the sternum.	C2
V3	Midway between locations V2 and V4.	C3
V4	At the mid-clavicular line in the fifth intercostal space.	C4
V5	At the anterior axillary line on the same horizontal level as V4.	C5
V6	At the midaxillary line on the same horizontal level as V4 and V5.	C6
RA	Right arm	R
LA	Left arm	L
RL	Right leg	N
LL	Left leg	F

Reusable Electrodes

Each electrode must be attached securely. The electrode paste, gel, or cream must cover an area the size of the electrode, but must not extend beyond it, especially on the chest.

Disposable Tab Electrodes

Disposable electrodes have conductive material on the adhesive side only. The electrode tab must be placed between (clip) or on (banana or pushbutton) the electrode adapter, and remain flat. Do not attempt to place the electrode adapter so close to the circular part of the electrode that the tab of the electrode is bent, or contact is made with the conductive gel. Gently tug on the electrode adapter to ensure that the electrode adapter is properly placed on the electrode. Good and accurate placement of each electrode on the first attempt is important. Each time an electrode is lifted off the skin and reattached, the adhesive gel becomes less effective.



Never mix reusable and disposable electrodes on the same patient.

2.3. Create a new ECG

To create a new test:

1. Select the patient. See the CPWS Workstation manual for details.
2. In the **File** menu, point to **New** and click **ECG**. The **New ECG** dialog box is displayed.

3. In the **New ECG** dialog box, select the Name and the **Specialty** of the **Referring physician** and/or the name of the **Ordering physician**, and select the lead set that you want to use for the ECG.
4. Click the **OK** button. The **Real-time monitor** is displayed. Here you can adjust your view settings and start recording the test.



5. When you are prompted to do so, switch on the recorder. The Pro recorder is switched on automatically. The **Real-time monitor** displays the ECG traces.

2.4. Select how you want to view leads

Once you have created a new ECG, the Real-time monitor displays the ECG traces. Before you start the actual recording, you can select how you want to view the traces. Welch Allyn CardioPerfect offers three different views: 1x12, 2x6 and 4x3. In addition, you can set different chart speeds and different sensitivities.

To select a different view:

- In the **Real-time monitor**, select a view from the list. The new view is immediately displayed.

To select a different chart speed or sensitivity for the view:

- In the **Real-time monitor**, select a chart speed or sensitivity from the list. The speed and sensitivity are immediately displayed.

2.5. Set a rhythm strip

As a default, Welch Allyn CardioPerfect uses lead II as a rhythm strip, but you can set any lead as a rhythm strip.

To set another lead as a rhythm strip:

- In the Rhythm strip pane, select a lead from the list. The new lead is immediately used as a rhythm strip.

To set the speed and the sensitivity of the rhythm strip:

- In the Rhythm strip pane, select a speed and sensitivity. The new speed and sensitivity are immediately used.

2.6. Turn pacemaker on and off

ECG traces can contain artificial pacemaker signal indicators. You can remove this artificial pacer indicator by disabling the "Show Pacer" selection. To learn how, see Customizing the Resting ECG software on 39.

2.7. Apply an AC filter

ECG traces can contain noise that is due to AC mains interference. This makes the traces harder to read. You can filter out noise by applying an AC filter. When you apply a filter, the original ECG signal is not permanently changed. You only change the way it is displayed on the monitor. You can always restore the original signal.

To apply an AC filter:

- At the top of the Real-time monitor, click **AC filter**. Click again to switch the filter off.

2.8. Apply a muscle noise filter

Muscle noise in an ECG signal hides low amplitude signals that may be important for the interpretation of an ECG. You can remove this noise with a muscle noise filter.

To apply a muscle noise filter:

- At the top of the Real-time monitor, click **Muscle filter**. Click again to switch the filter off.

2.9. Record an ECG

You are now ready to record the ECG.

To record an ECG:

1. In the **Real-time monitor** wait until the signal is stabilized and click the **Record** button to start recording. The progress of the recording is shown in the gauge at the bottom of the window.
2. Next see §2.1 follow steps 8-9.

Create a pretriggered recording

When you want to catch a particular event, such as arrhythmia, without having to record an entire ECG, you can use a pretriggered recording. When you start a pretriggered recording, it includes the five seconds before and after you clicked on the Record button. This means that when you see an event and click the Record button, your recording includes the event, five seconds before the event, and five seconds after the event.

The pretriggered option is also convenient when you have difficulties recording an ECG with clean traces, for example because the patient has muscle spasms. The pretrigger option helps defining the 10 seconds of recording by already saving 5 seconds of possibly clean traces.

To create a pretriggered recording:

1. Create a new test and switch on the MD or Portable recorder, the Pro is switched on automatically. The Real-time monitor is displayed.
2. In the **Real-time monitor**, click the **Pretrigger** option.
3. Wait until you see the event that you want to record.
4. As soon as you see the event, click the **Record** button. Welch Allyn CardioPerfect will continue recording for five more seconds.
5. Next see §2.1 follow steps 8-9.
6. The recorded ECG is automatically displayed, including the event that you wanted to capture.

2.10. Recording rhythm ECGs

The procedures for recording a rhythm ECG are almost identical to those for recording a regular ECG. If you need any detailed help with the steps that follow, please refer to section 2.1.

To record a rhythm ECG:

1. In the **Real-time monitor** wait until the signal is stabilized and click the **Rhythm** button to start recording. The progress of the recording is shown in the gauge at the bottom of the window.
2. Next see §2.1 follow steps 8-9.

Capture an event

When you notice an event, like arrhythmia, during recording, you can capture this in the ECG. When you do this, a small exclamation mark is inserted at the place where the event occurred.

- To capture an event, click the **Event** button.

2.11. Cancel a recording

You can cancel a recording at any time in the recording process.

To cancel a recording:

- Click the **Cancel** button in the **Real-time monitor**. The recording is cancelled and you are asked to switch off the recorder. The test is not saved.

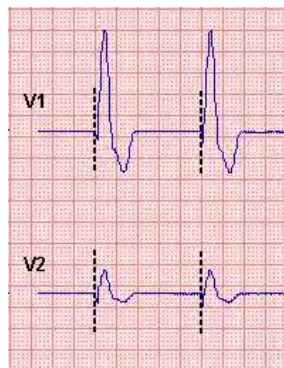
Tips for canceling a recording:

- When you have not yet recorded 10 seconds of regular ECG, you can also cancel the recording by clicking the **Record** button.
- You can choose to record a regular ECG or a rhythm ECG without leaving the real-time monitor.

2.12. Pacemaker pulse detection

The Welch Allyn CardioPerfect software is able to display pacemaker pulse spikes detected by the hardware. These spikes are marked with a symbol in the Real time monitor, in Review mode and on printouts.

When the Pacemaker pulse detection is on, the detected spikes are marked on the trace, as shown here. To learn how to disable this function to remove artificial pacemaker signal indicators, see Customizing the Resting ECG software on 39.



Pacemaker markers

2.13. Signal quality indication

If Welch Allyn CardioPerfect Workstation finds the signal from one of the channels to be erroneous, for example caused by a disconnected electrode, the monitor will display "Bad signal on...". The trace shows square waves, see example below.



Please check the indicated electrodes/channels immediately!

The status information is saved with the test. Erroneous leads will show square waves on both the Review and the printout. Depending on the duration of the erroneous signal no interpretation or measurement will be possible and therefore will not be shown.

In the few moments between a lead being disconnected and that event being detected by the software, pacemaker spikes may be erroneously detected. As a result, a group of pacemaker markers may be shown on the trace just before the square waves are shown. The pacemaker pulse detection will be suppressed as soon as the square waves are shown, and will continue to be suppressed until the erroneous signal is corrected.

Leadoff, Framing Errors and DCOffset conditions:

If the application detects a Lead-off, DC offset, or Framing error within 10 seconds after you have started an ECG recording, the recording automatically restarts. In the case of a Leadoff condition, the ECG recording will not start until the signal is stabilized. The progress bar of the recording will remain at 0 until all the signals are of acceptable quality.

You can use the override button to disable the automatic restart.

DCOffset The DCOFFSET DETECTED! message displays in the progress bar when battery power is interrupted or when there is a spike in voltage.

Framing Errors Framing errors display in the progress bar and can occur in CPWS configurations when the Pro recorder is connected via a serial cable and the packets of information are delayed.

Leadoff The Leadoff message displays in the workspace when an electrode is disconnected. The real-time monitor will display "Bad signal on...". The trace shows square waves until the signal is stabilized.

3. Recording ECGs for pediatric patients

Pediatric Electrode Placement

CardioPerfect supports two lead sets for the recording and interpretation of pediatric electrocardiograms. Where anatomically feasible, the standard electrode placement described on page 10 may be used. For very small children, an alternative arrangement is described below, in which leads V3R and V7 replace V3 and V5.

Extremity electrodes

The electrodes may be placed on any part of the arms or the legs as long as they are below the shoulders in the former and below the inguinal fold anteriorly and the gluteal fold posteriorly in the latter. Any other placement necessary by deformed or missing extremities must be noted on the record.

Pediatric Precordial electrodes

Place the electrodes on the anatomical positions V3R, V1, V2, V4, V6 and V7, then attach precordial lead wires 1 through 6 from left to right.

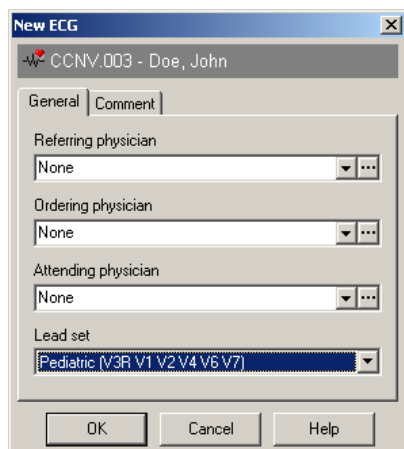
Connect the precordial electrodes in the following positions:

AHA		IEC
V1	Fourth intercostal space at the right border of the sternum (V3R).	C1
V2	Fourth intercostal space, at the right sternal margin (V1).	C2
V3	Fourth intercostal space, at the left sternal margin (V2).	C3
V4	Fifth intercostal space, on the left mid-clavicular line (V4).	C4
V5	Left midaxillary line, at the horizontal level of V4 (V6).	C5
V6	Left posterior axillary line, at the horizontal level of V4 (V7).	C6
RA	Right arm	R
LA	Left arm	L
RL	Right leg	N
LL	Left leg	F

To select the pediatric lead set:

1. Place electrodes on the patient.
2. In Welch Allyn CardioPerfect, select or create a patient.

3. In the **File** menu, point to **New** and click **ECG**. The **New ECG** dialog box is displayed.



4. From the **Lead set** list, select **Pediatric** and click **OK**.
5. Follow the steps on page 14 to finish recording the ECG.

To view an ECG:

-
- The screenshot shows the Pocket PC interface with two main sections. The top section, labeled "Patient list", contains a search bar with the text "Search:" and a "Go" button. Below the search bar is a list of patients with columns for "Number" and "Name". The patients listed are: CCNV.012 Brady / Tachy, CCNV.002 Caesar, J., CCNV.003 Doe, John, CCNV.013 Fainting attacks, CCNV.001 Jongmans, Stella, CCNV.010 Nodal tachycardia, and CCNV.008 Orymous, Ann. The bottom section, labeled "Test list", contains a table with columns for "Type" and "Date & time". The tests listed are: 5-2-2003 11:52:26, 8-2-2000 16:15:11, 7-10-1996 12:14:51 (highlighted), 13-6-1995 15:28:33, 12-6-1995 9:02:33, and 29-5-1995 12:16:33. The status bar at the bottom shows "CCNV.003 - John Doe".
- | Number | Name |
|----------|-------------------|
| CCNV.012 | Brady / Tachy |
| CCNV.002 | Caesar, J. |
| CCNV.003 | Doe, John |
| CCNV.013 | Fainting attacks |
| CCNV.001 | Jongmans, Stella |
| CCNV.010 | Nodal tachycardia |
| CCNV.008 | Orymous, Ann |
- | Type | Date & time |
|------|--------------------|
| | 5-2-2003 11:52:26 |
| | 8-2-2000 16:15:11 |
| | 7-10-1996 12:14:51 |
| | 13-6-1995 15:28:33 |
| | 12-6-1995 9:02:33 |
| | 29-5-1995 12:16:33 |
- CCNV.003 - John Doe

- [illegible]

The Information window gives you all kinds of information about the ECG that you are currently viewing. You can see the name of the referring physician, the name of the technician that recorded the ECG and any comments that were entered. If you wish, you can add some comments.

To view ECG information:

- In the **Tools** menu, click **Information**. The **Information** window is displayed.

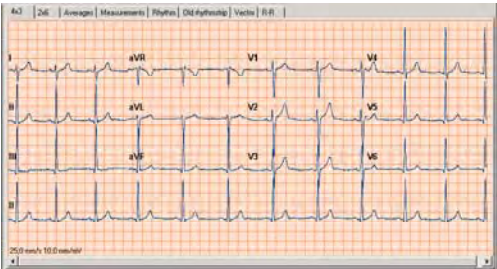
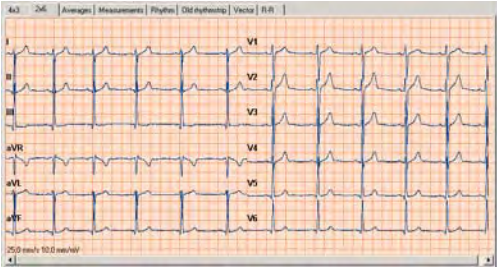
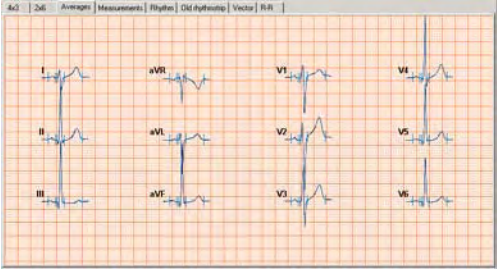
To add your comments:

1. Type your comments in the Information window.
2. Click **OK** to save your comments.

4.2. Views

Welch Allyn CardioPerfect offers various views on an ECG. Each view highlights a different aspect of the ECG. Each view is presented on a different tab in the workspace and has different functionality.

You can view at all twelve leads in two different formats (the traditional 4x3 format, and a convenient 2x6 format). But you can also view the measurements that Welch Allyn CardioPerfect calculated, or display one single average complex. If you recorded a rhythm ECG, you can examine the entire recording.

	<p>4x3 view</p> <p>The 4x3 view displays a 12 lead-ECG strip of 2.5 seconds long. The leads are shown in a 4x3 configuration with a rhythm strip at the bottom of the view.</p> <p>View can be simultaneous or sequential.</p>
	<p>2x6 view</p> <p>The 2x6 view displays a 12 lead-ECG strip of 5 seconds long. The leads are shown in a 2x6 configuration. On the left, leads I through aVF are displayed; on the right, leads V1 till V6 are displayed.</p> <p>View can be simultaneous or sequential.</p>
	<p>Averages view</p> <p>The Averages view displays the averages of the dominant complexes for all 12 leads. You can also view a single average complex, display markers and compare complexes of other ECGs.</p>

[illegible]

Measurements view

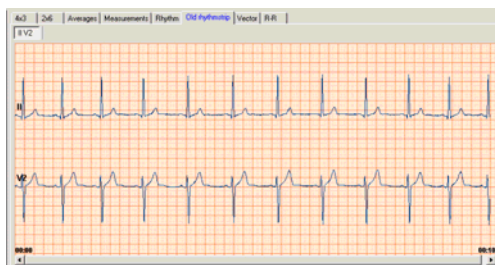
The Measurements view displays the measurements that were taken by the computer. These measurements include the values for several common parameters, such as Q, R and S amplitude and ST values. The amplitudes are expressed in microvolts. The durations are expressed in milliseconds. The measurements cannot be edited.



Rhythm view

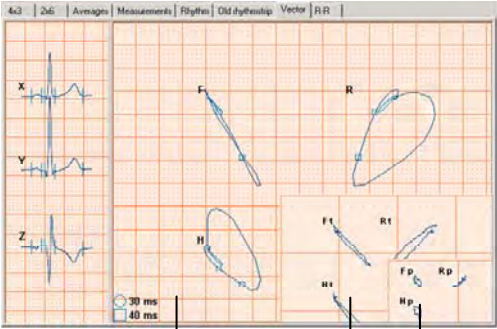
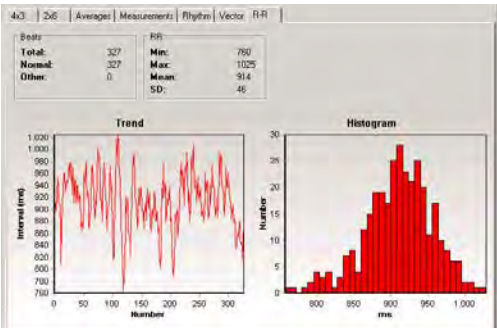
When you have recorded a rhythm ECG, you can view the entire ECG in the Rhythm view. You can use the scroll bar to move through the ECG.

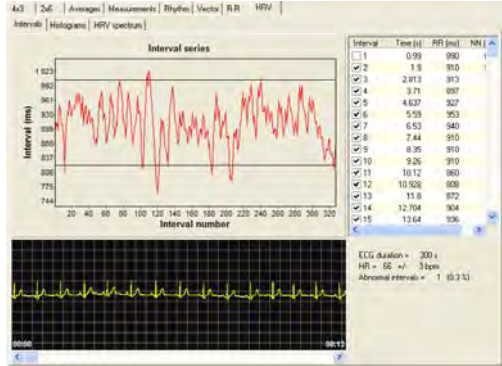
The Rhythm view displays leads in different groupings, so that you can easily switch between the most common groups.



Old rhythm strip

The Old rhythm strip view is only available for ECGs that were recorded with older versions of the Workstation software (software from before 2000). It displays the original II V2 rhythm strip.

	<p>Vector view (optional)</p> <p>The Vector view is only available if the vectorcardiogram option is enabled. It displays the results of an ECG in a vectorcardiogram.</p> <p>The left hand pane displays the reconstructed orthogonal x, y and z leads. The right hand side of the Vector view is divided into three windows.</p> <p>Window 1 displays the following loops:</p> <ul style="list-style-type: none"> • F: complete frontal loop • H: complete horizontal loop • R: complete right sagittal loop <p>Window 2 displays the following loops:</p> <ul style="list-style-type: none"> • Ft: frontal plane of the T wave • Ht: horizontal plane of the T wave • Rt: right sagittal plane of the T wave <p>Window 3 displays the following loops:</p> <ul style="list-style-type: none"> • Fp: frontal plane of the P wave • Hp: Horizontal plane of the P wave • Rp: Right sagittal plane of the P wave 																
 <table border="1"> <thead> <tr> <th colspan="2">R-R</th> </tr> </thead> <tbody> <tr> <td>Total:</td> <td>327</td> </tr> <tr> <td>Min:</td> <td>750</td> </tr> <tr> <td>Max:</td> <td>1025</td> </tr> <tr> <td>Normal:</td> <td>327</td> </tr> <tr> <td>Mean:</td> <td>914</td> </tr> <tr> <td>Other:</td> <td>0</td> </tr> <tr> <td>SD:</td> <td>46</td> </tr> </tbody> </table>	R-R		Total:	327	Min:	750	Max:	1025	Normal:	327	Mean:	914	Other:	0	SD:	46	<p>R-R view (optional)</p> <p>R-R is the interval between two subsequent QRS complexes. The R-R view gives an overview of the heart rate variability. This view lists the number of intervals, the minimum, maximum and average number, and the standard deviation.</p> <ul style="list-style-type: none"> • The Trend graph displays the duration of the subsequent intervals. The x-axis lists the interval numbers. The y-axis displays the duration. • The Histogram graph displays the distribution of the intervals. The x-axis lists the duration (in ms, divided into bins of 8ms). The y-axis lists the number of intervals that falls in a particular bin.
R-R																	
Total:	327																
Min:	750																
Max:	1025																
Normal:	327																
Mean:	914																
Other:	0																
SD:	46																



Interval	Time (s)	RR (ms)	NN (ms)
1	0.99	980	
2	1.9	910	
3	2.873	913	
4	3.71	897	
5	4.627	927	
6	5.58	953	
7	6.53	940	
8	7.44	910	
9	8.35	910	
10	9.26	910	
11	10.12	960	
12	10.938	908	
13	11.8	972	
14	12.704	904	
15	13.64	936	

ECG duration = 300 s
 HRI = 66 +/- 3 bpm
 Abnormal intervals = 1 (6.3 %)

HRV view (optional)
 This tab shows the heart rate variability. Additional information is available upon request.

***Note:** HRV option not sold in the US.*

The view in the workspace can be used in for example a Word document. Right-click in the Workspace and select copy from the pop-up menu; paste the view in a document.

4.3. Parameters

The lower part of the workspace contains the Parameters pane. The Parameters pane contains global parameters that are determined from all leads. These parameters are:

- Patient age and heart rate
- P and PQ duration
- QRS duration
- QT, QTc and QTd duration
- P, QRS and T axis

4.4. QTc

The QT interval in an ECG is a good indicator of the repolarization. However, the QT depends heavily on the heart rate. To make a useful measurement, the QT is usually corrected.

Welch Allyn CardioPerfect offers three correction methods that can be used to derive the QTc parameter:

- Bazett:

$$QT_{c_B} = \frac{QT}{\sqrt{RR}} = \frac{QT}{\sqrt{\frac{60}{HR}}} = QT \sqrt{\frac{HR}{60}}$$

- Fridericia:

$$QT_{c_F} = \frac{QT}{\sqrt[3]{RR}} = \frac{QT}{\sqrt[3]{\frac{60}{HR}}} = QT \sqrt[3]{\frac{HR}{60}}$$

- Hodges:

$$QT_{c_H} = QT + 1.75 * (HR - 60)$$

To select the QTc correction method:

1. In the **File** menu, click **Settings**. The **Settings** dialog box is displayed.
2. Click **ECG** and click on the **Viewing** tab.
3. Under **QTc method**, click the method that you want to use.
4. Click **OK** to save your changes.

4.5. QT dispersion (optional)

Note: *QT dispersion option not sold in the US.*

QT dispersion (QTd) is defined as the difference in duration between the longest QT interval and the shortest QT interval in any lead.

There are several ways of calculating the QT dispersion. These ways depend on:

- The reference point in the QRS complex from which the measurement should be started
- Whether the marker that indicates the reference point should be local or global. A local marker is one that is taken for each lead, and therefore differs for each lead. A global marker is one that is used for all leads, and therefore is the same for all leads.
- The number of leads that is used for calculation.

The QTd duration is calculated and displayed in the Parameters area of the view. You can specify a number of options that affect the calculation of the QTd duration.

To set QTd options:

1. In the **File** menu, click **Settings**. The **Settings** window is displayed.
2. Click **ECG** and click on the **QT dispersion** tab.
3. In the **QT dispersion** tab, select which reference point you want to use, and whether it should be local or global.
4. Select the number of leads you want to use, see section 8.1 for details.
5. Click **OK** to save your changes.

4.6. Working with views

There are a number of things you can do in a view. They fall apart in the following groups of actions:

Action	Function	Available in
Adjusting scales and magnitude of the view	Zoom in and out	4x3, 2x6, Averages, Rhythm, Old rhythm strip, Vector
	Reset zoom	4x3, 2x6, Averages, Rhythm, Old rhythm strip, Vector, R-R
	Set chart speed	4x3, 2x6, Averages, Rhythm, Old rhythm strip, Vector
	Set sensitivity	4x3, 2x6, Averages, Rhythm, Old rhythm strip, Vector
View one single average or loop	Enlarge	Averages, Vector
	Autosize	Vector
Improving signal quality	Apply muscle noise filter	4x3, 2x6, Averages, Rhythm, Vector
	Apply AC filter	4x3, 2x6, Averages, Rhythm, Vector
	Apply anti-aliasing	4x3, 2x6, Averages, Rhythm, Vector
Studying the ECG	Make measurements	4x3, 2x6, Averages, Rhythm, Vector
	Compare ECGs	Averages
	Display markers	Averages, Vector

On the next pages, each action is described in detail. Most of these actions are also available from the right-click menu.

4.7. Zoom in and out on an ECG

If you want to get a closer look at the traces, you can adjust the size of the leads with by zooming in and out of the ECG.

To see leads in more detail:

- In the **View** menu, click **Zoom in**.

To see a larger part of the ECG:

- In the **View** menu, click **Zoom out**.

To reset the zoom function and return to the standard lead size:

- In the **View** menu, click **Reset zoom**.

4.8. Set chart speed and sensitivity

Welch Allyn CardioPerfect offers a wide range of speed and sensitivity. You can adjust the scale of the ECG by adjusting the chart speed and the sensitivity.

To set the chart speed:

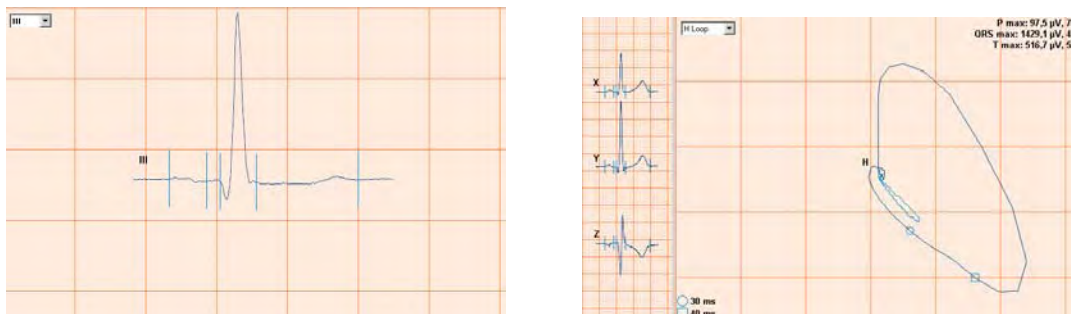
- In the **View** menu, point to **Chart speed** and select a value. The higher the chart speed, the more lead signal will be visible.

To set the sensitivity:

- In the **View** menu, point to **Sensitivity** and select a value. The lower the value, the lower the peaks in the lead signal will be.

4.9. View one single complex or loop

In the **Averages** view and the **Vector** view, you can view one single complex or loop.



To view a single complex or loop:

1. In the **Action** menu, click **Enlarge**. The first lead in an ECG (or the first loop in an VCG) is enlarged. With the autosize function, available from the right-click menu the selected loop will be shown as large as possible in the available space.
2. To enlarge another lead or loop, select it from the drop down in the upper left corner of the workspace.
3. To switch off the enlarge function, click **Enlarge** from the **Action** menu once more.

4.10. Turn pacemaker on and off

ECG traces can contain artificial pacemaker signal indicators. You can remove this artificial pacer indicator by disabling the "Show Pacer" selection. To learn how, see Customizing the Resting ECG software on 39.

4.11. Apply muscle noise filter

Muscle noise in an ECG signal hides low amplitude signals that may be important for the

interpretation of an ECG. You can remove this noise with a muscle noise filter.

To apply a muscle noise filter:

- In the **Action** menu, click **Muscle noise filter**.

4.12. Apply AC filter

ECG traces can contain noise that is due to AC mains interference. This makes the traces harder to read. You can filter out noise by applying an AC filter. When you apply a filter, you do not change the actual ECG signal. You only change the way it is displayed on the monitor. The ECG signal always keeps its original form.

To apply an AC filter while you view an ECG:

- In the **Action** menu, click **AC filter**.

4.13. Apply baseline filter

ECG traces can contain some baseline wander caused by movement. You can reduce this wander of the baseline by applying a baseline filter. When you apply the baseline filter you only change the display of the traces. The actual signal remains unchanged.

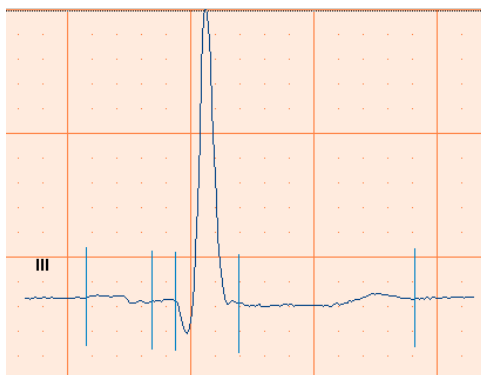
To apply a baseline filter while you view an ECG:

- In the **Action** menu, click **baseline filter**.

If accurate ST segment contours are required for ECGs, do not use the 0.5 Hz baseline wander filter. This filter suppresses baseline wander to the extent that it may alter the ST segment. Instead, configure your cardiograph to operate without the baseline wander filter. Regardless of the filter used, the rhythm characteristics of the ECG are accurately recorded and the filter settings do not affect the interpretation algorithm.

4.14. Apply anti-aliasing

When you view an ECG on a monitor, the signal can look ragged, especially when you zoom in on a complex. You can use anti-aliasing to make the signal look smoother. Anti-aliasing does not change the signal itself. It only affects how the signal is displayed on the monitor.



Before anti-aliasing



After anti-aliasing

To apply anti-aliasing:

- In the **View** menu, click **Anti-aliasing**.

4.15. Make measurements

In each view that displays leads, complexes or vectors, you can make measurements between two points.

To make a measurement between two points:

1. Move the crosshair pointer to the starting point of your measurement.
2. Double click on the starting point. Welch Allyn CardioPerfect inserts a mark.
3. Move the crosshair pointer to the end point of your measurement.
4. Double click on the end point. Welch Allyn CardioPerfect draws a line between the two points and displays the measured values.

To clear all measurements:

- In the **Action** menu, click **Refresh**.

4.16. Compare ECGs

If a patient has had several ECGs, Welch Allyn CardioPerfect can make a serial comparison of the average complexes of these ECGs. In such a comparison, the curves are superimposed in such a way that the starting points of the QRS complexes coincide. Serial comparison is only possible in the Averages tab.

To compare ECGs:

1. In the **Tools** menu, click comparison. The **Comparison** dialog box is displayed. This dialog box contains all other ECGs that have been recorded for this patient.



2. In the **Comparison** dialog box, select one or more ECGs to which you want to compare your ECG.
3. Click **OK**. The selected ECGs are now displayed.

4.17. Display markers

Markers are convenient reference points that mark global points in an average complex or vector. You can use a marker as a starting point for your observations or measurements. You can only view markers in the Average and Vector tabs.

Welch Allyn CardioPerfect inserts markers at the following points:

- Start P wave
- End P wave
- Start QRS complex
- End QRS complex
- End T wave

To display markers:

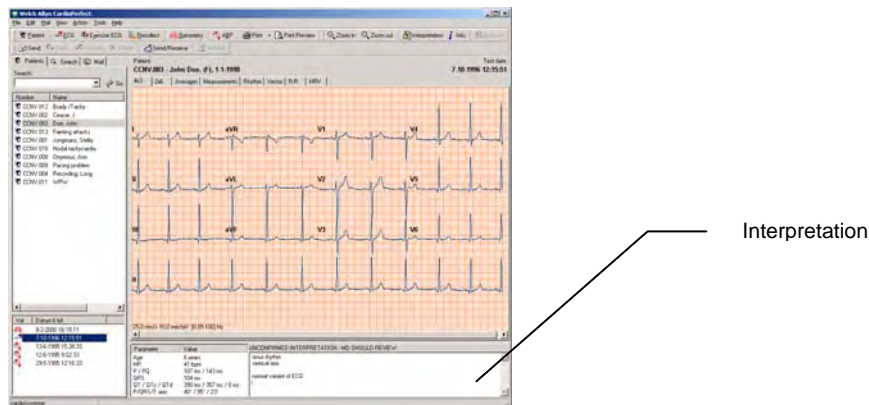
- In the **View** menu, click **Markers**. The markers are displayed.

Tips for displaying markers:

- You can set the color of the markers in the ECG settings.
- You can also use your right mouse menu for displaying markers.

5. Interpreting ECGs

When you view an ECG, the interpretation is shown in the lower right corner of the workspace. If you have the optional MEANS software installed on your computer, this software makes an initial interpretation for you. If not, this is where you can enter your own interpretation.



5.1. About MEANS and PEDMEANS interpretation software

MEANS is short for Modular ECG Analysis System. PEDMEANS is short for Pediatric Modular ECG Analysis System. They are ECG interpretation programs developed by the University of Rotterdam in the Netherlands, and can be used to interpret ECGs that were recorded with Welch Allyn CardioPerfect.

MEANS and PEDMEANS use an algorithm that consists of signal processing, measurements, rhythm and contour classification. The adult algorithm is applicable to patient ages 18 and higher. The pediatric algorithm is applicable for ages 1 day through 17 years.

MEANS and PEDMEANS interpretations consist of

- A number of statements in different categories
- Reasoning supporting the statement
- A conclusion
- An indication of the severity of the ECG

Missing information

The MEANS algorithm uses the gender and the age of a patient to make a reliable interpretation. If this information is not present in the patient card, the following assumptions are made:

- The patient is male
- The patient is 35 years old

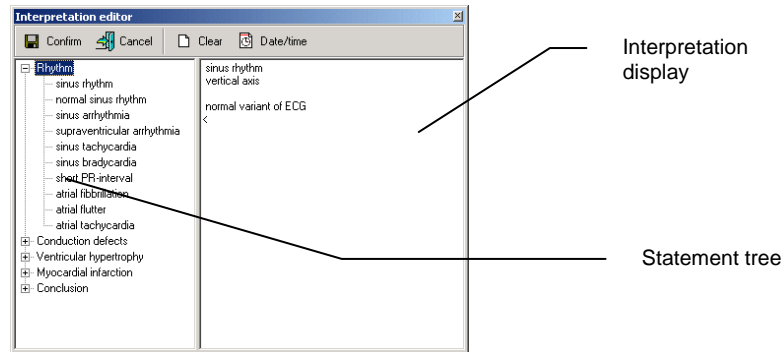
If these values are used, this is mentioned at the top of the interpretation.

Important: A computer-generated interpretation cannot replace sound medical reasoning by a trained professional. Therefore, a physician should always review the interpretation.

5.2. Edit and confirm an interpretation

You can edit an interpretation in the Interpretation editor. In this editor, you can enter your own

texts. Alternatively, you can use the statement tree to select and enter common interpretation statements. Once you edit an interpretation, you must confirm it. Otherwise, your changes will not be saved.



To edit and confirm an interpretation manually:

1. In the **Tools** menu, click **Interpretation**. The Interpretation editor is displayed.
2. In the Interpretation display, at the pointer, start typing.
3. Click the **Confirm** button to save your comments and to return to the ECG.

To edit and confirm an interpretation with the statement tree:

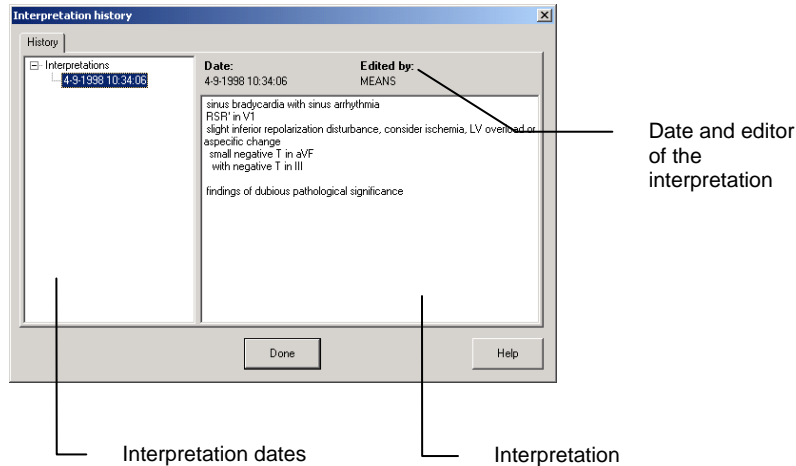
1. In the **Tools** menu, click **Interpretation**. The Interpretation editor is displayed.
2. From the statement tree, click on one of the categories to display all possible statements for that category.
3. From a category, click on the statement that you want to include in the interpretation. The statement is added.
4. To delete a statement from the interpretation, select the statement text and press BACKSPACE to delete it.
5. Click the **Confirm** button to save your comments and to return to the ECG.

Tips for editing and confirming an interpretation:

- You can automatically insert the current date and time by clicking the **Date/time** button.
- You can clear the interpretation editor by clicking the **Clear** button.
- When you return to the ECG after confirming an interpretation, the interpretation header shows the date and time of confirmation and the name of the person that confirmed it.
- The statement tree can be changed. Please consult your system administrator or local dealer for new or changed statements.

5.3. View interpretation history

When you change something in an interpretation, Welch Allyn CardioPerfect does not change the original interpretation, but creates a new one. This way, you never lose any information. A copy of all interpretations is kept in the interpretation history.



To view the interpretation history:

1. In the **Tools** menu, click **History**. The **Interpretation history** window is displayed. The left hand pane displays the interpretations sorted by date. The right hand pane shows the content of each interpretation, plus the interpretation date, time and editor.
2. Click on a date to view an interpretation.

5.4. Reanalyze an ECG

When you have overwritten a MEANS interpretation with a manual interpretation, you can always get the MEANS interpretation back. To do this, you need to reanalyze the ECG.

To reanalyze an ECG:

- In the **Tools** menu, click **Reanalyze**. The original MEANS interpretation is placed back in the interpretation window.

6. Printing ECGs

6.1. Print an ECG

You can make a printout of each view in the ECG at any time between recording and interpretation. There are two ways of manually printing an ECG:

- One view: Welch Allyn CardioPerfect prints one view in the way it is displayed on the monitor.
- Selected formats: Welch Allyn CardioPerfect prints a number of views simultaneously.

Print formats

The resting ECG Module can print the following reports:

- 12 averages + 6 rhythm leads
- 2x6, all pages
- 2x6, two pages 50 mm/s
- 2x6
- 4x3, 25 mm/s
- 4x3, 50 mm/s
- 4x3 5 mm/mV
- 4x3 20 mm/mV
- Averages
- Large averaged complex
- Measurements
- OldRhythm
- Rhythm
- R-R
- Vectors
- HRV

Each report contains the view and a header that displays additional information.

Please refer to the Workstation manual for further information on printing ECGs.

6.2. Automatically print an ECG

Welch Allyn CardioPerfect can automatically print an ECG directly after recording and after confirming the interpretation. To automatically print an ECG, you need to enable automatic printing and select the ECG formats to be printed.

To enable automatic printing:

1. In the **File** menu, click **Settings**. The **Settings** dialog box is displayed.
2. Click **ECG** and click on the **Printing** tab.
3. In the **Printing** tab, click **Print after recording** and/or **Print after interpretation confirmed**.
4. Click **OK** to confirm.

7. Maintaining the recorder



For proper care of the PROlink and patient cables, do not wrap the cables around the PRO recorder during storage.

To keep your Welch Allyn CardioPerfect recorder in good working condition, please observe the following:

- Remove the battery when you do not use the recorder for a longer period of time.
- Do not expose the recorder to temperatures lower than -15° C or higher than 45° C, at a maximum non-condensing humidity of 95%.
- Clean the cables regularly.
- Replace the battery of the recorder when the power indicator light is red.
- Keep the USB connector attached to the PC USB port to protect the PROlink cable's USB connector. If your workflow requires repeatedly disconnecting the PC from the PROlink cable, use a USB extension cable to connect the PROlink cable to the PC. Disconnect the extension cable from the PC USB connector to protect the PROlink cable connector.

7.1. Cleaning the Patient cables and PC interface cables

When you use electrodes that need electrode gel, make sure that the cables and the non-disposable electrodes are cleaned regularly. Otherwise, the gel may build up on the wires.

Clean the non-disposable electrodes with a soft cloth moistened with a recommended disinfectant or cleaning agent.

Cleaning cables: patient cables, plugs and power cords should be kept clean using lukewarm soapy water or a neutral cleaner.

Disinfecting the cables: use chemical disinfectants containing ethanol (70%-80%), propanol (70%-80%) or aldehydes (2%-4%).



Do not: Clean the patient or PC interface cables with pure alcohol.
Alcohol can cause the plastic to become brittle and may cause the cable to fail prematurely.
Do not: Autoclave the cables or use ultrasonic cleaners.
Do not: Immerse the patient or PC interface cables.
Do not: Wet the connectors.

7.2. Replace the battery of the recorder

Note: After you have replaced or charged the batteries, let the Welch Allyn Cardio Perfect software run in Monitor mode for a few seconds. This verifies that the recorder functions properly and the optical cable is undamaged.

Welch Allyn CardioPerfect Portable or MD recorders

Welch Allyn CardioPerfect Portable or MD recorders get their power from a 9V alkaline battery or optionally from an AC mains adapter. You need to replace the battery when the power indicator light becomes red instead of green. Do not use the recorder when the power indicator LED is red.

To replace the battery of Welch Allyn CardioPerfect MD models:

The battery compartment is located at the bottom of the unit.

1. Place your fingers in the two recesses of the battery compartment.
2. Remove the lid by squeezing it.
3. Unfasten and remove the battery.
4. Insert a new 9V alkaline battery.
5. Click the lid back into place.



It is **strictly forbidden** to use a non-medical approved 9V AC mains adapter, because of patient safety.

**Please observe the following:**

We advise you not to use rechargeable batteries, because their voltage can drop steeply without warning. This can stop the ECG monitoring during a test.

To replace the battery of Welch Allyn CardioPerfect portable models:

The battery compartment is located at the bottom of the unit.

1. Remove the battery lid with a pair of tweezers.
2. Remove the battery.
3. Insert a new 9V alkaline battery.
4. Click the lid back into place.

**Caution****Please observe the following:**

We advise you not to use rechargeable batteries, because their voltage can drop steeply without warning. This can stop the ECG monitoring during a test.

The Welch Allyn CardioPerfect Pro recorders

The Welch Allyn CardioPerfect Pro recorders get their power either via a USB connection or via a rechargeable battery. If a USB-Prolink is used, the Welch Allyn CardioPerfect Pro recorder gets its power from the USB port of the computer, the battery pack supplied with the recorder is then a so-called dummy.

If the recorder is connected to the computer by means of an RS232 Prolink, the power is supplied by a battery-pack in the bottom of the recorder, this battery pack needs to be recharged (charger is supplied with the system) when the indicator turns red.

**Caution**

If the recorder is powered from the USB port, but also has a battery pack, this battery will be drained slowly as well and if the recorder detects an empty battery it will not function until the battery is recharged or removed.

After you have replaced or charged (Pro) the batteries, let the Welch Allyn Cardio Perfect software run in Monitor mode for a few seconds. This verifies that the recorder functions properly and the optical cable is undamaged.

To charge the battery of the Welch Allyn Pro Recorder:

The battery compartment is located at the bottom of the unit.

1. Pull the battery compartment from the recorder by holding the Welch Allyn Cardio Perfect Pro recorder with one hand and pressing on both sides off the battery compartment with

your other hand.

2. Connect the power adapter to an electrical outlet, insert the charger cable into the top of the battery pack. Recharge your battery.
3. Click the battery compartment back into place when the battery has been recharged.

8. Customizing the Resting ECG software

You can customize the Welch Allyn CardioPerfect software to your own preferences. The features that you can customize are located in the ECG settings (**File > Settings**).

8.1. General tab

In the **General** tab, you can configure a number of common options that are used by Welch Allyn CardioPerfect.

The **General** tab contains the following options:

Default chart speed	From this list, you can select the default monitoring chart speed. Possible values are 5, 10, 12.5, 25, 50, 100 mm/sec.
Default sensitivity	From this list, you can select the default monitoring sensitivity. Possible values are 5, 10 or 20 mm/mV.
Extremity lead order	With this option you can choose from two different lead orders: Standard (aVL, I, -aVR, II, aVF, III) and Cabrera (I, II, III, aVR, aVL, aVF).
Maximum recording length	The maximum number of seconds for a rhythm recording.
Anti-alias monitor	If this option is selected, your monitor is anti-aliased, so that the curves of the ECG signal appear smoother.
Show new ECG dialog	If this option is selected, the New ECG dialog box is displayed when you start a new ECG. Otherwise, you are taken straight to the Real-time monitor to start recording. See page 12 for more details.
Ask for lead set on pediatric patients	If this option is selected and you select a pediatric patient, Welch Allyn CardioPerfect will ask you whether you want to use a pediatric lead set.
Show Pacer	By disabling this setting, you can remove artificial pacemaker signal indicators. For example, see Pacemaker pulse detection on page 15.
Amplitude unit	The unit in which the amplitude is displayed. This can be either micro volts or millimeters.
Muscle filter frequency	This setting will affect the high cutoff frequency that is used by the muscle filter.

8.2. Viewing tab

In the **Viewing** tab you can configure the settings that determine how the ECGs will be displayed on the screen.

The **Viewing** tab contains the following options:

QTc method (Bazett, Hodges, Fridericia)	With this option you can set the method that should be used to correct the measured QT.
AC filter mode	With this option you can set the mode of the AC mains filter.
Appearance	Here, you can specify individual colors for the background, grid lines, grid dots, trace, begin and end of the QRS complex, the markers, the T wave and the font that is used in the ECG.
Color schemes	This list lets you choose from a number of predefined color formats.
Grid style	From this list you can select the style of the grid in which the ECG is displayed. You can either leave out the grid, use lines to represent the grid, or display a full grid.

8.3. Printing tab

In the **Printing** tab, you can configure automatic printing and selected formats. The **Printing** tab contains the following options:

Default report templates	From this list of templates, you can select the formats that are printed when automatic printing is enabled. These formats are also printed when you click Print selected formats in the ECG window.
Grid	From this list, you can select the grid style in which the selected formats should be printed.
Print after recording	If this option is selected, the ECG is automatically printed when the recording has finished. Welch Allyn CardioPerfect prints the formats that you selected in the Default report templates area.
Print after interpretation is confirmed	If this option is selected, the ECG is automatically printed when the interpretation of the ECG has been confirmed. Welch Allyn CardioPerfect prints the formats that you selected in the Default report templates area.
Print calibration pulse	If this option is selected, the calibration pulse will be printed.

8.4. QT dispersion tab

The QT dispersion tab is only visible when you have purchased the QT dispersion software. Use the QT dispersion tab to set your preferences for the calculation of the QT dispersion.

Note: *QT dispersion option not sold in the US.*

The **QT dispersion** tab contains the following options:

Reference point In the Reference point area, you can specify from which reference point in the QRS complex the measurement should be started, and whether that reference point should be the same for all leads (global), or whether it should be set for each lead (local).

Leads In the Leads area, you can specify the number of leads you want to use in calculating the QT dispersion.

Reference point

If you select...	Then...
<i>Local Q</i>	Reference point is local Q point.
<i>Local J</i>	Reference point is local J point.
<i>Global Q</i>	Reference point is global Q point.
<i>Global J</i>	Reference point is global J point.

Leads

If you select...	The leads that are used are...
6	6 precordial leads
8	The shortest peripheral lead The mean of all other peripheral leads
10	6 precordial leads All peripheral leads except the shortest and the longest one.
12	All 12 leads.

8.5. Recorder Tab

In the **Recorder** tab, you can configure your Welch Allyn CardioPerfect recorder. You can only access this tab when you have administrator rights or when the software security is switched off.

The **Recorder** tab contains the following options:

Model The recorder model that is used. Use the MDX4 option for a MD or portable, use the MDXN1 for a Pro recorder.

Frequency The sampling frequency of the recorder (either 300, 600 or 1200 Hz).

Port The communication port of the PC to which the recorder is connected. This can be a standard serial port, a CPCOM ISA, a CPCOM PCI card, a CPCOM PCMCIA card, or a USB port.

When operating in a thin-client environment, the application displays an additional option, called PerfectLink™. This option allows the use of the PRO recorder with a USB cable in thin client environments. This only works with the PRO recorder; therefore, the recorder type is automatically set as well.

Address If you use a CPCOM ISA card, enter the address here.

IRQ If you use a CPCOM ISA card, enter the IRQ here.

AC filter (Hz) The frequency that is filtered by the AC mains filter. This can be either 50 or 60 Hz.

Recorder options

Display switch off message This option disables the display of the message "Switch recorder off" after a test has been completed. If a Welch Allyn CardioPerfect Pro recorder with USB connection is used this option should be off/unchecked. Make sure this option is checked if a RS232 connection is used.

Battery options

Enable low battery warning This option is only available for the PRO (MDXN1) recorder. With this option you can enable or disable the displaying of a low battery warning in the monitor.

Warn at In this field you can specify the remaining battery time at which the monitor should display the low battery warning.

8.6. Customize ecg.txt

You can customize the statements that are used in the Comment editor according to your own preferences. Please refer to the Workstation manual for further instructions.

9. Troubleshooting

In this chapter, some known problems and possible solutions are described.

The program does not respond when the recorder is switched on

- Check the battery and replace or charge it when necessary. Make sure that the optical fiber is properly connected.
- When you work with a Unilink, check whether you have configured the software to use the correct COM port.
- When you use an ISA-CPCOM card, make sure that the address on the card matches the setting for the address in the **Recorder** tab. Also make sure that the IRQ you are using is not used by another device.

When you start a recording you do not see the ECG traces on the screen and you receive a number of errors

- Make sure that the setting for the sampling frequency in the **Recorder** tab of the ECG settings matches the sampling frequency of your recorder. The sampling frequency can be either 300, 600 or 1200 Hz.

Some buttons or menu entries are inactive

- This is probably caused by the fact that your user role does not allow you to perform the actions of those buttons or menu entries.

Test recovery

To recover a test after the database connection has been lost:

If during the test the connection to the database is lost, for example because of a loose network cable, the test will be saved in a file called "Emergency saved resting ECG #x.MDW" (x stands for a number, which is automatically generated) in the database folder named in the error message. After the database connection has been restored, this file can be imported into the database by using the import function in the Workstation (File – Import, browse to the folder and select the correct file).

Technical Support

If you have a technical question that you cannot answer with the provided tools, please contact our Installation & Support department or contact your local distributor.

When you contact the Installation & Support department via phone, e-mail or fax, please provide the following information:

- Your name, company name, address, phone number, fax number and e-mail address.
- Product serial number.
- Exact product name and version number.
- Type of operating system.
- Type of installation (network or standalone).
- A copy of the Technical Support Form.

- Complete description of the problem and the steps to reproduce it. If applicable we would also like to have the exact error message.

To print the Technical support form:

1. In the **Help** menu, click **Information**.
2. Click on the **Registration** tab.
3. Click on the **Support...** button. The Welch Allyn CardioPerfect support form is now printed and saved as file MDW.txt in the MDW installation directory. You can fax the printout or e-mail the file.

10. Function keys

The Welch Allyn CardioPerfect module is, just like all Windows applications, designed for working with the mouse. However, there might be situations in which working with the keyboard can be quicker. Therefore a number of functions within the Welch Allyn CardioPerfect module can also be selected directly using the keyboard. Here is a list of all available keyboard shortcuts in this module, for a more general function key description please refer to the Workstation manual:

Viewing	
Key	Function
[SHIFT]+[CTRL]+[E]	Starts a new Resting ECG recording.
[CTRL]+[I]	Opens the Interpretation window
[CTRL]+[H]	Opens the Interpretation History
[CTRL]+[DOWN]	Zooms out.
[CTRL]+[UP]	Zooms in.
[CTRL]+[E]	Enlarge average complex or vector loop.
[CTRL]+[M]	Activates the markers (only active in the 'Averages' and 'Vector' tab).
[CTRL]+[R]	Activates the refresh functionality, which clears all user made measurements.

Real time monitor	
Key	Function
F2	Start/stop test
[Esc]	Exit the recording.
F12	Starts a long recording (In Real Time Monitor).
[INS]	Inserts an event in the recording (Real-time monitor only)

11. Before installing the Resting ECG software

In this chapter, you will find information about the structure of the Welch Allyn CardioPerfect resting ECG software.

11.1. Structure

The workstation consists of two elements:

- Hardware: the recorder and the interface to the computer.
- Software: the Resting ECG module that runs in the Welch Allyn CardioPerfect Workstation.

The recorder must be connected to the computer that runs the module.

Software

The resting ECG module is automatically installed with Welch Allyn CardioPerfect Workstation. For instructions on how to install and configure Welch Allyn CardioPerfect Workstation, please refer to the Installation manual.

Hardware

Three different types of recorders are available, the Portable recorder, the MD recorder and the Pro recorder. The recorder with a patient cable, with which you record the ECG, is connected to the PC through an interface; different types of interfaces are available:

- The Portable- or MD recorder communicates with the computer through an optical fiber which is connected to a so-called Unilink (USB or RS232) or to a so-called CPCOM card.
- The Pro recorder uses a Prolink USB or Prolink RS232 to communicate with the computer.

Install Unilink or CPCOM?

A Unilink is a small optical to electrical interface. There are two versions of the Unilink: the serial or RS232 Unilink and the USB Unilink.

The Welch Allyn CardioPerfect ECG recording system can optionally be supplied with a CPCOM card. This is an expansion card which plugs into a PCI expansion slot. This card essentially takes over the function of the Unilink but, compared to the RS232 version, it has an additional capability to buffer the incoming data.

12. Installing the Resting ECG Module

Before you can start recording ECGs, you need to

- Install the hardware
- Install the correct drivers (when you use a CPCOM card or USB Unilink)
- Configure the software

The installation procedures of the CPCOM cards depend on the operating system of your computer. Therefore, all sets of instructions include explanations for each operating system.

12.1. Connecting the RS232 interface

(Unilink for Portable- or MD- or Prolink for Pro recorder)

The RS232 Interface can be used with all versions of MS Windows. To use a RS232 Interface, you need a free serial port on your computer.

To set up your computer for use of the RS232 Interface:

1. Connect the RS232 Interface to one of the serial ports of the computer.
2. If a Pro-recorder is used, connect the other end of the interface directly to the recorder.

If a Portable or MD recorder is used, insert one end of the optical fiber into the optical output receptacle at the back of the recorder and insert the other end into the respectable on the interface.

After you have connected the Interface you need to configure Welch Allyn CardioPerfect Workstation so that it uses the correct port.

To configure Welch Allyn CardioPerfect Workstation:

1. Start Welch Allyn CardioPerfect Workstation and log in as Administrator.
2. In the **File** menu, click **Settings**, click **ECG**, and click on the **Recorder** tab.
3. From the **Port** list, select the COM port to which the Interface is connected. Most often this is either COM1 or COM2.

12.2. Connecting the USB interface

(Unilink for Portable- or MD- or Prolink for Pro-recorder)

The USB Interface cannot be used with MS Windows 95 or MS Windows NT4. To use an USB Interface, you need a free USB port on your computer.

On the Installer menu of the Welch Allyn CardioPerfect Workstation you will find an item called "Install Unilink USB / CardioPerfect Pro Drivers."

→ Please run this install prior to inserting the USB-Interface into a USB socket of your computer.

The installation wizard will prompt you to select whether the USB-Unilink drivers or the Prolink-USB drivers should be installed

To set up your computer for use of the USB Interface:

1. Connect the USB Interface to the USB port of the computer.
2. If a Pro-recorder is used, connect the other end of the interface directly to the

recorder.

3. If a Portable or MD recorder is used, insert one end of the optical fiber into the optical output receptacle at the back of the recorder and insert the other end into the receptacle on the interface.

When you connect the USB Interface to a USB port for the first time, the system will tell you that it has found new hardware and it is trying to locate the drivers for it, provided that you have executed the installation of the drivers from the installer menu, the drivers will be detected automatically and correctly setup (this may take a few minutes).

If, at a certain moment the USB interface is inserted into another USB port, the driver setup will be repeated automatically

To configure Welch Allyn CardioPerfect Workstation:

1. Start Welch Allyn CardioPerfect Workstation and log in as Administrator.
2. In the **File** menu, click **Settings**, click ECG, and click on the **Recorder** tab.
3. From the **Port** list, select Unilink **USB** (This is the default setting after a new installation)

Note: In the Drivers\USB directory on the installation CD, you will also find a subdirectory called Legacy. Inside you will find a previous version of the Unilink USB driver setup. This version has been placed on the CD for the following purpose; on some systems you will receive a port error 1 during the recording. This happens when the drivers do not get enough time from the system to transfer the information from the recorder to the software. Down grading to these drivers will solve your problem. For the instructions on how to down grade your drivers please refer the readme.txt file, which you can find on the Drivers\USB\Legacy subdirectory on your installation CD.

12.3. Install the PCI CPCOM card

(Portable or MD recorder only)

When you want to use a PCI CPCOM card you need to have a free PCI slot on your computer. The installation of the PCI CPCOM card is relatively easy and can be done by following the instructions below:

1. Open the computer.
2. Insert the PCI CPCOM Card in an empty PCI slot and close the computer.
3. Start the computer. The system will ask you for a driver when logging on to the computer for the first time after you installed the card.

For Windows:	Install the driver by running the setup program that is located on the Workstation CD, in the directory:
2000 / XP	R:\Drivers\CPCOM-PCI\Win2000\

"R" stands for the drive letter of your CD_ROM drive.

4. Restart the computer.

Configuring the Software

After you have installed the PCI CPCOM card you need to configure the Workstation software in order to allow communication between the program and the PCI-CPCOM card.

To configure Welch Allyn CardioPerfect Workstation:

1. Start Welch Allyn CardioPerfect Workstation and log in as Administrator
2. In the **File** menu, click **Settings**, click **ECG** and click on the **Recorder** tab.
3. Set the **Port** setting to CPCOM-PCI.
4. Click **OK** to save your settings.

12.4. Install the PCMCIA CPCOM Card

(Portable or MD recorder only)

The use of a PCMCIA CPCOM card requires a free type II PCMCIA slot and is not supported on Windows NT 4.

The installation of the PCI CPCOM card is relatively easy and can be done by following the instructions below:

1. Insert the Card into the PC.
2. The operating system will ask you for a driver upon insertion of the card into one of the PCMCIA slots.

For Windows:	Select the driver file that is located on the Welch Allyn CardioPerfect Workstation CD in the:
2000 / XP	R:\Drivers\ CPCOM-PCMCIA\Win2000\

"R" stands for the drive letter of your CD_ROM drive.

Configuring the Software

After installing the card you need to configure the Workstation software in order to allow communication between the program and the card.









To configure Welch Allyn CardioPerfect Workstation:

1. Start Welch Allyn CardioPerfect Workstation and log in as Administrator.
2. In the **File** menu, click **Settings**, click **ECG** and click on the **Recorder** tab.
3. Set the **Port** setting to CPCOM-PCMCIA.
4. Click on **OK** to save your settings.

13. Safety and precautions

Conventions

- WARNING -** Warning statements describe conditions or actions that can result in personal injury or loss of life.
- CAUTION -** Caution statements describe conditions or actions that can result in damage to the equipment or software.
- NOTE -** Notes contain additional information on cardiograph usage.

	Attention (Caution, Warning, Danger, Important, Note, Refer to Accompanying Documentation)
	Ingress Protection (ordinary)
	Serial Number
	Reference Number
	Type BF Equipment, defibrillation protected
	Manufacture Date
	CE Mark (according to MDD 93/42/EEC)
	Temperature Range

	Direct Current
---	-----------------------

Electromagnetic Compatibility

When using the Cardio Perfect Pro cardiograph, electromagnetic compatibility with surrounding devices should be considered and evaluated. The Cardio Perfect Pro cardiograph complies with IEC 60601-1-2 limits for EMC.

General Safety and Precautions tips



Radio Frequency (RF) interference between the cardiograph and any existing RF transmitting or receiving equipment at the installation site, including electrosurgical equipment, in close proximity to the cardiograph should be evaluated before the equipment is operated as they may seriously degrade performance.

The Cardio Perfect Cardiograph is susceptible to interference from RF energy sources (lowered RF immunity) which exceed the IEC 60601-1-2 limits, such as power line bursts, other medical devices, cellular products, information technology equipment and radio/television transmission.

To reduce EMC interference the cardiograph shall be separated from the emitting source as much as possible. If assistance is needed, call your local Welch Allyn service representative.

Artifact on the ECG caused by electromagnetic interference should be evaluated by a physician or physician authorized personnel to determine if it will negatively impact patient diagnosis or treatment.

Like all electronic devices, this cardiograph is susceptible to electrostatic discharge (ESD). Electrostatic discharge typically occurs when electrostatic energy is transferred to the patient, the electrodes, or the cardiograph. ESD may result in ECG artifact that may appear as narrow spikes on the cardiograph display or on the printed report. When ESD occurs, the cardiograph's ECG interpretation may be inconsistent with the physician's interpretation.

Welch Allyn assumes no liability for failures resulting from RF interference between Welch Allyn medical electronics and any radio frequency generating equipment when these levels exceed those established by applicable standards.

Patient and Operational Safety

The cardiograph isolates all connections to the patient from electrical ground and all other conductive circuits in the cardiograph. This reduces the possibility of hazardous currents passing from the cardiograph through the patient's heart to ground. To ensure the patient's safety and your own please observe the following:

Any system components (e.g. treadmill, personal computer, ergo meter) that require to be connected to an outlet socket shall use only grounded power cords (three-wire power cords with grounded plugs). Also make sure the outlet accepts the plug and is grounded. **Never** adapt a grounded plug to fit an ungrounded outlet by removing the ground prong or ground clip.

Multiple portable outlet sockets shall not be placed on the floor. Multiple portable outlet sockets or extension cord shall not be connected to the system. Do not connect items which are not part of the system. The use of multiple (non-) medical electrical equipment connected to the same patient may pose a safety hazard due to the summation of leakage currents from each instrument. Any combination of (non-) medical electrical equipment should be evaluated by local safety personnel before put into service. Multiple portable outlet sockets use without an isolation transformer is disapproved unless casual access for additional equipment is impeded or prevented.

Patient cable and Interface cable



The patient cable supplied with the CardioPerfect cardiograph is an integral part of the cardiograph's safety features. Using any other patient cable may compromise defibrillation protection as well as cardiograph performance. The patient cable should be routed away from power cords and any other electrical equipment. Failure to do so can result in AC power line frequency interference on the ECG trace.



Do not touch the patient, patient cable, PC interface cable (Prolink) or cardiograph during defibrillation. Death or injury may occur from the electrical shock delivered by the defibrillator. It is recommended to check the patient cable and PC interface cable (Prolink) for damage prior to the use of the system. If damage exists do not use the cable, contact your local Welch Allyn Sales Office or your authorized Welch Allyn dealer or distributor to have the cable replaced.

Index

12 lead-ECG	21	General tab	39
2x6 view	21	Printing tab	40
4x3 view	21	QT dispersion tab	41
AC filter	10, 28	Recorder tab	42
Apply	28	Viewing tab	40
AC mains interference	10, 13, 14, 28	Ecg.txt	42
Action menu	13, 14, 27, 28, 29	Edit ECG information	20
Anti-aliased	28, 39	Electrode placement	10
Apply AC filter	13, 28	End	30
Apply anti-aliasing	28	P	30
Ask for leadset	39	QRS	30
Automatically print an ECG	34	Enlarge	27
Averages	27, 29, 30	Enter IRQ	42
Averages view	21	Event	15
AVF	21	Capture	15
Bazett	24, 40	Events button	10, 14
Cables	35	Extremity leadorder	39
Cabrera	39	File menu	24
Calculating	25, 41	Filter	10
QT	25, 41	Fridericia	24, 40
Cancel recording	15	General settings	39
Capture an event	15	Global J	41
Chart speed	27	Global Q	41
Clean	35	History	33
Clean cables	35	Hodges	24, 40
Compare ECGs	29	Information	20
Comparison dialog	29	Information window	20
Complex	27	Install	
Confirm button	31	PCI CPCOM card	48
Confirm interpretation	31	PCMCIA CPCOM Card	49
Connect		Interpretation	31, 33
USB Unilink	47	Interpreting ECGs	31
CPCOM	42	IRQ	42
CPCOM PCI	42	J	41
Create	14	Leads	41
Pre-triggered recording	14	Leadset	39
Create a new patient	12	Local J	41
Curves	39	Local Q	41
Customize Cardio Perfect	39	Loop	27
Date/time button	31	Maintaining recorder	35
Default report template	40	Make measurements	29
Delete measurements	29	Manually print	34
Display ECG traces	13	Markers	30
Display markers	30	MEANS	31
Drivers	48	MEANS Interpretation software	33
ECG	10, 27, 28, 31, 33, 34	Measurements	29
Automatic print	34	Measurements view	22
Compare	29	Muscle noise filter	14, 27
Interpreting	31	Old rhythm strip view	22
Open	26, 34	Open	26, 34
Reanalyze	33	ECG	26, 34
Record	10, 13	P	30
Record rhythm	14	End	30
View	28	Start	30
ECG settings	39	pacemaker signal indicators	13, 15, 27, 39

Resting ECG Module - User Manual

Parameters	24, 25	R-R view	23
Patient	12	RS232 Unilink	46
Create new	12	Sagittal plane	23
PCI CPCOM card		Select	24
Install	48	QTc correction method	24
PCMCIA CPCOM Card		Sensitivity	27
Install	49	Set	13
Place electrodes	10	Chart speed	27
Plane	23	Rhythm strip	13
Precordial leads	25	Sensitivity	27
Pre-triggered recording	14	Set QTd options	25
Pre-triggered recording	14	Shortcut keys	45
Print	34	Show Pacer	39
ECG	34	Start	30
Print settings	40	P	30
Printing	34	QRS	30
Q	41	Tools menu	20, 31, 33
QRS	25, 30, 40, 41	Traces	13
Complex	41	Troubleshooting	43
End	30	Unilink	
Start	30	RS232	46
QT	24, 25, 41	USB	46
Calculating	25, 41	USB	42
Dispersion settings	41	USB Unilink	46
QT dispersion	25	Connect	47
QTc correction method	24	V1	21
QTd	25	V6	21
QTd options	25	Vector	27, 30
QT dispersion settings	25	Vector view	23
Real-time monitor	10, 13, 14, 15, 39	View	13, 20, 27, 28, 31, 33
Reanalyze ECG	33	2x6	21
Record	10, 13, 14	4x3	21
ECG	10, 13, 14	Averages	21
Record button	14, 15	Complex	27
Recorder maintenance	35	ECG	13, 28, 31
Recorder settings	42	ECG information	20
Reference point	41	Interpretation history	33
Refresh	29	Leads	13
Remove measurements	29	Loop	27
Repolarization	24	Measurements	22
Reset zoom	26	Old rhythm strip	22
Rhythm	14	Rhythm	22
Rhythm button	14	R-R	23
Rhythm ECG	14	Vector	23
Rhythm strip	13	View menu	27, 30
Rhythm view	22	View settings	40
Right sagittal plane	23	Zoom	26