

FLUKE®

Biomedical

Ansur Impulse 6000D/7000DP

Plug-In

Users Manual

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Chapter 1

Introduction

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Ansur Software

Ansur Test Automation software is the foundation for all Fluke Biomedical test systems. Ansur manages test procedures by allowing both manual and visual automated test sequences.

The software works hand-in-hand with Fluke Biomedical analyzers and simulators, creating a seamless integration for:

- Visual inspections
- Preventive maintenance
- Work procedures
- Performance tests
- Safety tests

Ansur Plug-ins

Ansur Test Executive software utilizes plug-in modules that work with a wide array of Fluke Biomedical instruments. The plug-in module is a software interface that provides test elements to the Ansur Test Executive program. This scheme allows the use of a similar user interface for all analyzers and simulators supported by Ansur.

With the purchase of a new Fluke Biomedical analyzer or simulator, it is possible to update existing Ansur software by installing a new plug-in. Each plug-in module allows users to work with only the options and capabilities needed for the instrument under test.

About This Manual

This users manual is designed to assist the reader in using the Ansur Impulse 6000D/7000DP Plug-In with Ansur software. The manual covers all features specific to the plug-in. Familiarity with both Ansur software and Microsoft Windows and their features will help in the design and use of tests for the Ansur Impulse 6000D and 7000DP Analyzers.

Impulse 6000D/7000DP Plug-In

The Ansur Impulse 6000D/7000DP Plug-In provides remote access to the Impulse 6000D and 7000DP Defibrillator Analyzers, referred to throughout this document as the “Analyzer.” In addition to the general test plug-ins, specialized plug-ins address all test requirements for specific instruments.

Note

The Impulse 6000D/7000DP Defibrillator Analyzer Users Manual explains the Analyzer’s capabilities and use.

Create and use Ansur test procedures with Ansur Impulse 6000D/7000DP test elements to incorporate the capabilities of an Analyzer into automated testing. Users can customize tests to analyze specific performance requirements. There are unique test elements for each of the tests, and simulations typically run on the Analyzer.

Additional References

In addition to this manual, answers to questions using the Analyzer or PC may be found in the following sources:

- *Fluke Biomedical Impulse 6000D/7000DP Users Manual*
- *Fluke Biomedical Ansur Test Executive Users Manual*
- Microsoft Windows Help and Support Center

Software Updates

Updates for Ansur are published on the Fluke Biomedical website, <http://www.flukebiomedical.com>.

Terms and Abbreviations

Table 1-1 lists terms and abbreviations used in this manual.

Table 1-1. Terms and Abbreviations

Term	Description
Ansur	Ansur is a software suite using plug-ins to perform test and inspection procedures in conjunction with several Fluke Biomedical test instruments.
DUT	Device Under Test—the equipment subjected to a test using the Analyzer
Impulse 6000D/7000DP	Defibrillator Analyzer from Fluke Biomedical
Plug-In	Add-on software program that extends Ansur so that it can interface with a specific Fluke Biomedical test instrument to configure it for a specific test and to automatically collect the measured data (if applicable)
Test Element	An Ansur construct that encapsulates test configuration and results A test template is built of several test elements.
Test Guide	A window displayed by Ansur or any of its plug-ins when a test element is being performed
Test Record	An Ansur file containing the results of a performed test template The test record can be printed as a test report.
Test Template	An Ansur file containing a set of test elements that define how a particular DUT is to be tested A test template can also contain instructions on how to perform service, preventive maintenance, repair, and other tasks on a DUT.

Chapter 2

Getting Started

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Introduction

This chapter describes installation of the Impulse 6000D/7000DP Plug-In and its use together with the Ansur Test Automation software and the Analyzer.

Note

An Analyzer is not necessary to create test templates and experiment with the functionality available in Ansur and the Impulse 6000D/7000DP Plug-In. However, actual tests cannot be performed unless the Analyzer is connected to the computer.

System Requirements

The following are recommended minimum requirements for installation:

- Microsoft Windows 2000 or Windows XP or Vista operating system
- Fluke Biomedical Ansur V2.4.0 or newer
- 50 MB of available hard drive for software
- Hard drive space (from 100 k to several megabytes) for result and template files

Installing the Impulse 6000D/7000DP Plug-In

The Impulse 6000D/7000DP Plug-In must be installed on the computer before the features described in this user manual can be implemented. For information on obtaining the Ansur software and the Impulse 6000D/7000DP Plug-In, contact the local Fluke Biomedical representative or visit the Fluke Biomedical website (<http://www.flukebiomedical.com>).

Note

Ansur version 2.4.0 or newer must be installed before the Impulse 6000D/7000DP Plug-In can be installed and used.

Download the Impulse 6000D/7000DP Plug-In from the Fluke Biomedical website and follow the steps below:

Note

When downloading the Impulse 6000D/7000DP Plug-In from the Fluke Biomedical web site, it is possible to run the installation without first downloading.

Note

When installing Ansur or any of its components/plugin on computers running Microsoft Vista, it is important to perform the installation as the Administrator for that computer. Otherwise the registry will not be properly updated and Ansur will not work properly.

1. Open **Windows Explorer** and browse to the saved Impulse 6000D/7000DP Plug-In installation program file, usually named **AnsurImpulse7000Plug-InVn.n.n.msi**, where *n.n.n* is the plug-in version number.
2. Double-click the installation program. The installation extracts the plug-in elements and displays the **Welcome** dialog box.
3. Click **Next** to display the license agreement.

4. Select the checkbox for “**I accept the terms in the license agreement,**” and click **Next** to display the default destination folder.
5. Choose one of the following options:
 - Click **Next** to accept the default destination folder in which Ansur was installed.
 - Click **Change** if Ansur has been installed in a different folder. In this case, the destination folder for the plug-in is changed so that it resides in the same directory as the Ansur program.

Note

If Ansur has been installed in a different destination folder from the default, be sure to use the same folder for the Impulse 6000D/7000DP Plug-In.

6. Click **Install** to begin the installation. A progress bar indicates the status of the plug-in installation.

After a few minutes, the installation concludes, and the window displays the dialog box and the **Finish** button.
7. Click **Finish**. The plug-in will load when Ansur is started.

Entering License Key

When using the plug-in for the first time, the user is prompted to enter a software license key provided by Fluke Biomedical at the time of purchase.

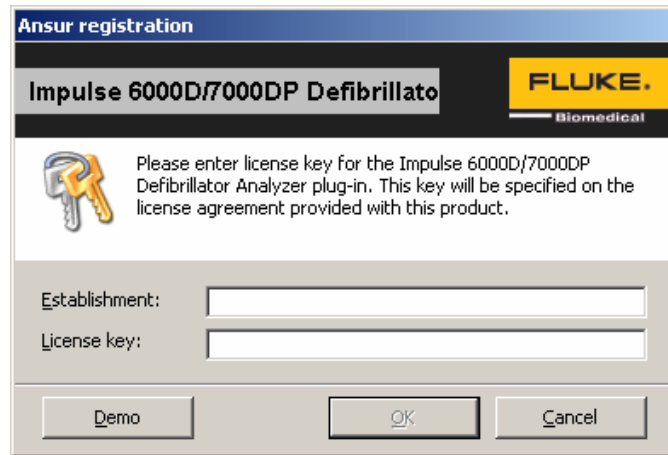
Note

Test templates can be created without a license key by using the demonstration mode. Demonstration mode allows many of the tasks described in this user manual. However, a user may not save or print without licensing the plug-in.

1. Start Ansur by doing one of the following:
 - Double-click the **Ansur** icon on the desktop.
 - From the **Start** menu, select **Start | Programs | Fluke | Ansur**.

Note

The license key dialog box shown in Figure 2-1 appears at startup if a license key has not yet been entered for the plug-in.



fcz01.bmp

Figure 2-1. Ansur Registration Screen - License Key

2. Enter the **Establishment Name** and the plug-in **license key**. If a license key is not available, click the **Demo** button to start Ansur in demonstration mode.

Note

Because the license key is derived from the establishment name, both strings must match the license information provided by Fluke Biomedical. This information is case sensitive and space sensitive. If the establishment name has been entered in the past, this field is already filled in

3. Click **OK** to start Ansur.
4. Click **Cancel** to prevent the plug-in from being loaded.

Uninstalling the Plug-In

To uninstall the Impulse 6000D/7000DP Plug-In:

1. Select **Start | Control Panel** and double-click **Add or Remove Programs**.
2. Locate and select the entry named **Ansur Impulse 6000D/7000DP Plug-in**, as shown in Figure 2-2.



fcz02.bmp

Figure 2-2. Removing Impulse 6000D/7000DP Plug-In

3. With the entry highlighted, click the **Remove** button.
4. When asked to verify the removal, click **Yes**. A dialog box with a progress bar displays while the Impulse 6000D/7000DP Plug-In is being removed from the computer.

When the plug-in is no longer listed in the **Add or Remove Programs** window, it has been completely removed.

Ansur Main Window

At startup, Ansur displays the **Main Application** window shown in Figure 2-3. Test templates can be created and edited from this window.

Test Explorer

The left pane of the **Main Application** window is called the **Test Explorer**. It displays the installed plug-ins available in Ansur.

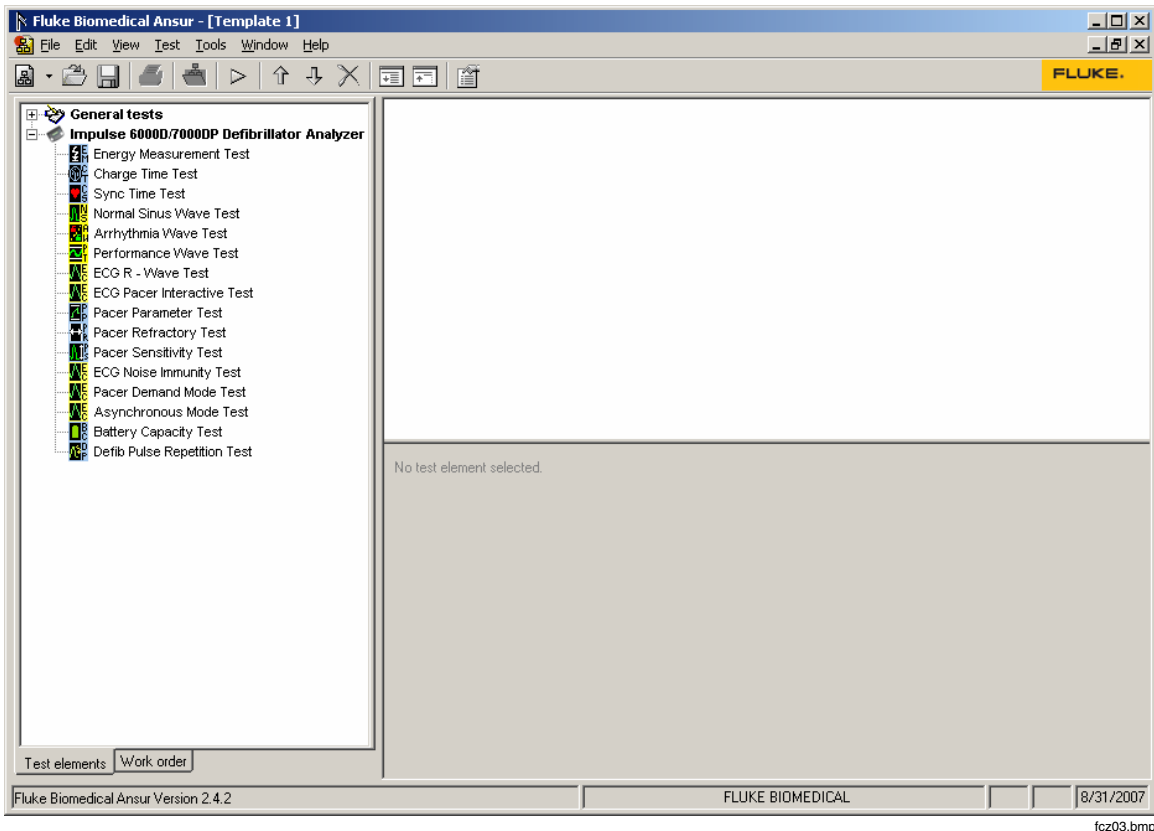


Figure 2-3. Impulse 6000D/7000DP Main Application Window

fcz03.bmp

Look in the **Test Explorer** to verify that a plug-in has loaded properly following installation. If **Impulse 6000D/7000DP Defibrillator Analyzer** is listed, the plug-in correctly loaded during startup.

Test Elements

To expand the list and view the available plug-in test elements in the **Test Explorer** window, either click the + (plus) symbol to the left of the plug-in name or double-click the name itself; in this case **Impulse 6000D/7000DP Defibrillator Analyzer**. Expanding the plug-in displays the list of test elements, as shown in Figure 2-4.

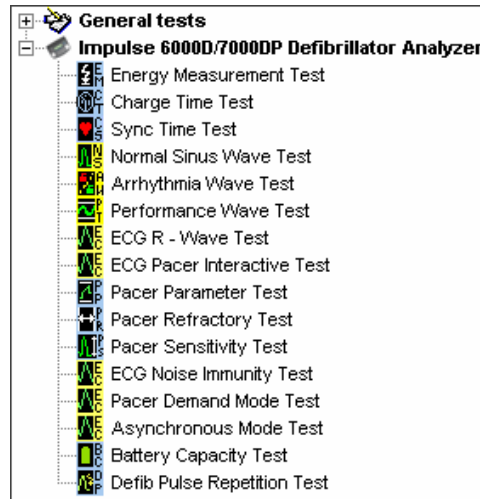


Figure 2-4. Impulse 6000D/7000DP Test Explorer Window

fcz04.bmp

Plug-In Preferences

The plug-in preferences allow selection of default settings that best suit normal instrument use. Defaults typically handle most performance testing requirements.

To change plug-in preferences:

1. Start the Ansur Test Executive program.
2. Click **Tools | Options** to display the **Preferences** window shown in Figure 2-5.

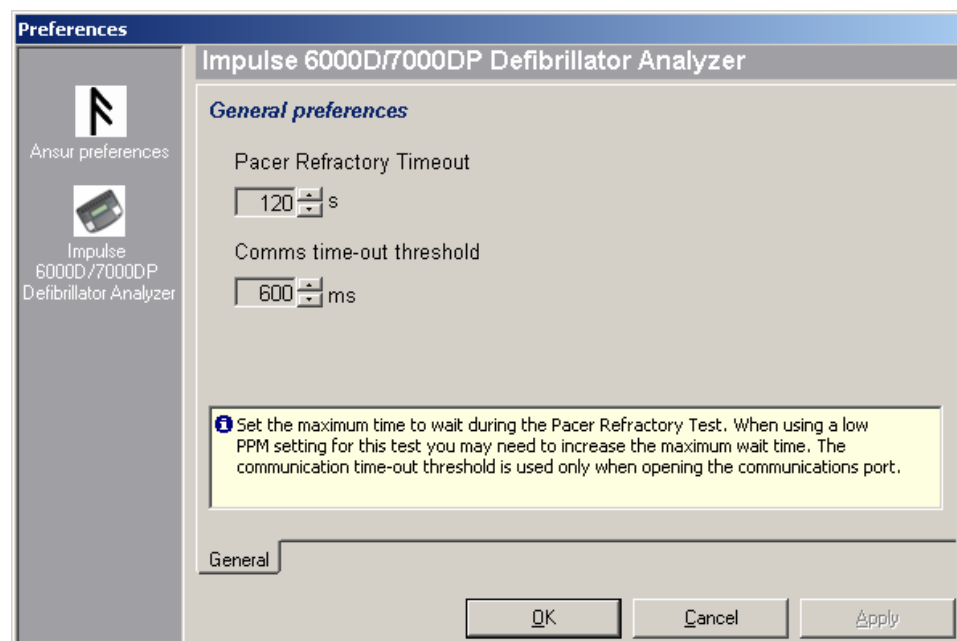


Figure 2-5. Defibrillator Analyzer Preferences

fcz05.bmp

3. Click the **Impulse 6000D/7000DP Defibrillator Analyzer** icon. The window opens with the **General** tab displayed.

In this window, the Pacer Refractory Timeout can be changed; this is the time to wait during the Pacer Refractory test. Tests with low pulses-per-minute may require additional wait time; make adjustments accordingly. The other preference that can be adjusted is the communications timeout threshold. The timeout threshold is the maximum time allowed for communications to be initiated before triggering an error.

4. Click **OK**.
5. Restart Ansur for changes to take effect.

Chapter 3

Impulse 6000D/7000DP Tests

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Ansur Test Guide

This manual includes tests unique to the plug-in for the Analyzer. For overall information on selecting and executing tests with Ansur software, please refer to the latest version of the *Ansur Executive User Manual*.

When a test is executed with the Impulse 6000D/7000DP Plug-in, the **TEST GUIDE** window opens. Use the **TEST GUIDE** to step through each element in the test procedure. Figure 3-1 shows the **TEST GUIDE** for an Energy Measurement test. The panes function as follows:

- Left pane – displays either the default explanation or one entered when a custom template was created.
- Right pane – provides step-by-step directions for the test being performed.
- Test results pane – the bottom pane that displays results of the test being run.

In this example, the screen directs the setting of the energy level for the DUT, in this case a defibrillator. Press **Start** on the **TEST GUIDE** toolbar to begin the test. Analyzer measurement results appear in the **Test results** pane.

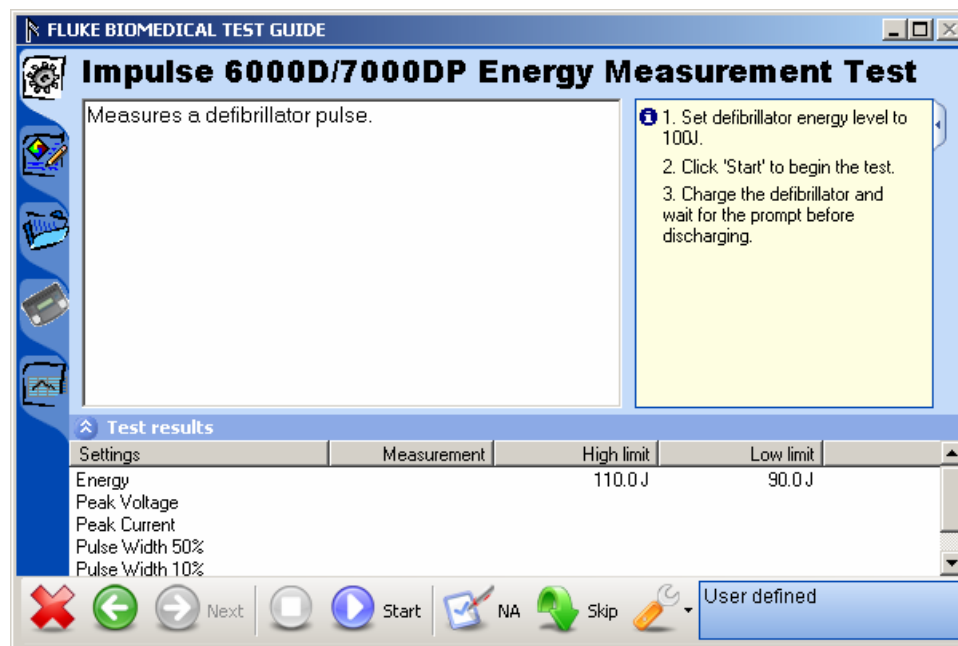


Figure 3-1. Ansur Test Guide Window

fcz06.bmp

External Load Box Selection

The Impulse 7000DP can test defibrillators at different loads when used with the Impulse 7010 Selectable Load. It provides defibrillator loads at 25, 50, 75, 100, 125, 150, 175 and 200 Ω . Refer to the *Impulse 7010 Instruction Sheet* for connection to and use with the Impulse 7000DP. Impulse 7000DP Firmware version 1.04 or above is required to perform the Selectable Load function.

To notify the Ansur software that the Impulse 7010 is being used for defibrillator testing and which load setting is selected, open the Energy Measurement Test element shown in Figure 3-2. Ensure the External Load checkbox is checked and set the load value in the dropdown box below the Load label.

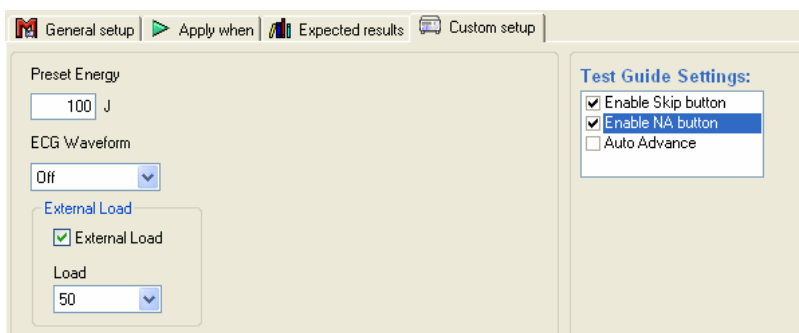


Figure 3-2. Custom Setup Dialog

When External Load is not checked, load selection is disabled and 50 Ω is used. Information will appear in the Test Guide View at run time notifying the user the 50 Ω internal load is selected and the 7010 External Load should be disconnected for the Impulse 7000DP for this test.

Note

Always ensure External Load is not checked when testing with the Impulse 6000D as it does not have the external load feature.

Defibrillator Tests

The Impulse 6000D/7000DP Plug-in allows testing of defibrillator performance using a PC running the Ansur software. At the conclusion of each test procedure, Ansur collects the results of the tests to display or to store on a PC.

Energy Measurement Test

The energy tests verify the accuracy of the energy delivered by the defibrillator.

To run an Energy Measurement test:

1. First connect the defibrillator to the Analyzer (refer to the *Impulse 6000D/7000DP Users Manual* for connection instructions) and set the defibrillator to the energy setting displayed in the information block in the right pane of the **TEST GUIDE** window. Figure 3-3 shows an energy setting with both high and low limits (in Joules).
2. Click **Start** in the **TEST GUIDE** toolbar.
3. Charge the defibrillator.

Ansur software configures the Analyzer for the defibrillator test, indicating the status in the **Test results** pane. Wait for Ansur to finish configuring the Analyzer.

4. When configuration is complete, a window displays the prompt to discharge the defibrillator.
5. Discharge the defibrillator. Test results appear in the **Test results** pane immediately.
6. To view a graph of the discharge curve, as shown in Figure 3-3, click the graph tab located along the left side of the **TEST GUIDE**.

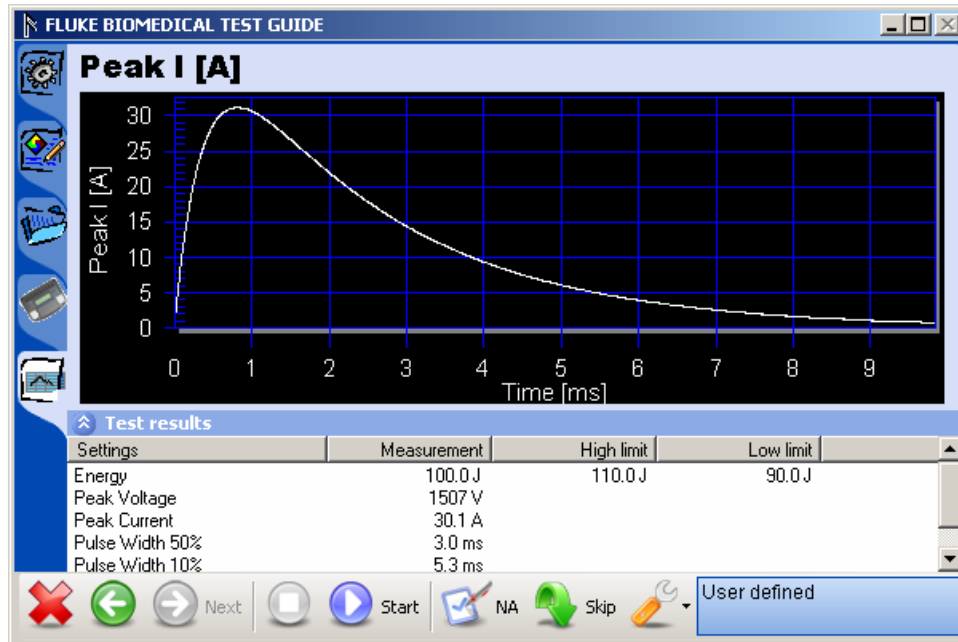


Figure 3-3. Graph of Discharge Curve

fcz07.bmp

Charge Time Test

The Charge Time test measures how long it takes to charge the defibrillator to a specified energy level. This test should use the defibrillator’s maximum available energy level.

The steps for this test are similar to the Energy Measurement test; however, the prompts are different, because the Charge Time test tracks *how long* it takes to perform the charge and discharge.

To run a Charge Time test:

1. Connect the defibrillator to the Analyzer.
2. Set the defibrillator to the energy level indicated in the information block in the right pane of the **TEST GUIDE** window.
3. Click **Start** in the **TEST GUIDE** toolbar. A progress window displays “**Please wait...**” while Ansur configures the Analyzer.

Once configuration completes its routines, a five-second countdown starts, and a warning “**START CHARGE NOW...**” displays.

4. When the warning appears, begin charging the defibrillator.

5. When charging is complete, discharge the defibrillator. Test results appear in the **Test results** pane.

Sync Time Test

The Sync (Synchronization) Time test determines the ability of the defibrillator to synchronize the discharge of its output pulse with a simulated ECG waveform being generated from the Analyzer.

To run a Sync Test:

1. Connect the defibrillator to the Analyzer and set defibrillator to the energy setting indicated in the **TEST GUIDE** settings pane.

The Analyzer outputs an ECG waveform to the defibrillator for this test.

2. Click **Start** in the **TEST GUIDE** toolbar.
3. Charge the defibrillator. Ansur configures the Analyzer for the defibrillator test, indicating the status in a **Test results** pane.
4. Wait for Ansur to finish configuring the Analyzer. When configuration is complete, a window displays the prompt “**Defibrillate now.**”
5. Discharge the defibrillator. Results of the test appear in the **Test results** pane.

Pacemaker Tests

Pacemaker tests are used to test the basic operation of external transcutaneous pacemakers by measuring various pacemaker outputs and timing.

Pacer Parameter Test

The Pacer Parameter test takes measurements that can be used to determine if the output of a pacemaker is correct.

To run a Pacer Parameter test:

1. Connect a pacemaker to the Analyzer.
2. On the pacemaker, set the pacer rate and pacer output current. The right pane of the **TEST GUIDE** window indicates the pacemaker current level to be used.
3. Click **Start** in the **TEST GUIDE** toolbar.
4. When the Analyzer completes its measurements, Ansur retrieves the results and displays them in the **Test results** pane.
5. Click **Stop** in the **TEST GUIDE** toolbar to conclude the test.
6. Click **Next** to proceed or click **Start** to run the test again.

Pacer Refractory Test

The Pacer Refractory test checks the ability of the pacemaker to interact with cardiac activity when the pacemaker is in demand mode. The Ansur program retrieves the Pulsed Refractory Period (PRP) and the Sensed Refractory Period (SRP) timings as measured by the Analyzer.

To run a Pacer Refractory test:

1. Connect the pacemaker to the Analyzer.

2. On the pacemaker, set the pacer rate and pacer output current using information specified in the right pane of the **TEST GUIDE** window.
3. Click **Start** in the **TEST GUIDE** toolbar. Ansur starts the test, which takes up to two minutes (120 seconds) to complete. The default duration of 120 seconds can be changed in the **Preferences** dialog box.

When the Analyzer has completed measurements, Ansur retrieves the results and displays them in the **Test results** pane.

4. Click **Next** in the **TEST GUIDE** toolbar to proceed to additional tests, or click **Start** to repeat this test.

Pacer Sensitivity Test

The Pacer Sensitivity test outputs a waveform and determines what threshold amplitude of ECG signal is needed to trigger the pacemaker.

To run a Pacer Sensitivity test:

1. Connect the pacemaker to the Analyzer.
2. On the pacemaker, set the pacer rate and pacer output current using information specified in the right pane of the **TEST GUIDE** window.
3. Click **Start** in the **TEST GUIDE** toolbar. Ansur starts the test and displays a message indicating to wait until the test is complete.

When the Analyzer has completed measurements, Ansur retrieves the results and displays them in the **Test results** pane.

4. Click **Next** in the **TEST GUIDE** toolbar to proceed to additional tests, or click **Start** to repeat this test.

Pacer Demand Mode Test

This Pacer Demand Mode test verifies that the demand mode of the pacemaker is operating correctly over a range of ECG rates.

To run a Pacer Demand Mode test:

1. Follow the directions provided by the DUT equipment manufacturer to connect the ECG leads from the ECG monitor to the Analyzer.
2. Click **Start** in the **TEST GUIDE** toolbar.
3. Check whether the ECG monitor responds correctly. Also note that this test can be set up to cycle through a range of ECG rates.
4. Click the **Test passed** checkbox or the **Test failed** checkbox to record the observed result of the test.

Asynchronous Mode Test

This test follows the same procedure as the Pacer Demand Mode but is run with the pacer in non-demand mode.

ECG Pacer Interactive Test

The ECG Pacer Interactive test simulates a patient response to a pacemaker.

To run an ECG Pacer Interactive test:

1. Follow the directions provided by the DUT equipment manufacturer to connect the ECG leads from the ECG monitor to the Analyzer.
2. Click **Start** in the **TEST GUIDE** toolbar.
3. Check whether the ECG monitor responds correctly based on the settings being used for the test.
4. If the test duration is set to run indefinitely, click **Stop** in the **TEST GUIDE** toolbar to conclude the test.
5. Click the **Test passed** checkbox or the **Test failed** checkbox to record the observed result of the test.

ECG Waveform Simulation Tests

The ECG Waveform tests are used to verify the correct operation of an ECG monitor.

Normal Sinus Wave Simulation Test

The Analyzer can generate a normal sinus wave between 10 and 360 beats per minute for output to a defibrillator ECG monitor.

To run a Normal Sinus Wave Simulation test:

1. Follow the directions provided by the ECG equipment manufacturer to connect the ECG leads from the ECG monitor to the Analyzer.
2. Click **Start** in the **TEST GUIDE** toolbar.

Wait for activity to appear on the ECG monitor. Note the BPM reading. This short test concludes automatically after a few seconds, as specified by the test procedure.

3. If the test duration is set to run indefinitely, click **Stop** in the **TEST GUIDE** toolbar to conclude the test.

4. Enter the **BPM** observed on the ECG monitor.
5. Click the **Test passed** checkbox or the **Test failed** checkbox to record the observed result of the test. If the BPM is outside the limits specified in the test procedure, the test is automatically marked as failed.

Arrhythmia Wave Test

The Arrhythmia Wave test typically verifies the shock advisory capability of a defibrillator in response to various arrhythmia waveforms.

To run an Arrhythmia Wave Test:

1. Connect the device under test (DUT) to the Analyzer. Set up the shock advisory on the defibrillator, if applicable.
2. Click **Start** in the **TEST GUIDE** toolbar. Wait for activity to appear on the ECG monitor and verify the shock advisory was correct. The test concludes automatically after a few seconds, as specified by the test procedure.
3. If the test is set to run indefinitely, click **Stop** in the **TEST GUIDE** toolbar at any time to end the test.
4. Click the checkbox **Test passed** or the checkbox **Test failed** to record the test result based on what was observed on the monitor.

Performance Wave Simulation

The Performance Wave simulation tests the integrity of a defibrillator monitor using a variety of additional waveform shapes such as square, triangle, sine, and pulse.

Refer to the *Normal Sinus Wave Simulation* test procedure for directions in running this test.

ECG R-Wave Test

The ECG R-Wave (Peak Detection) test determines if the defibrillator can detect an R Wave at a given threshold of width and amplitude. Beats per minute can range between 30 and 250 BPM. This test is set up to test a single R-wave width and amplitude, or it can cycle through several widths or several amplitudes.

To run an ECG R-Wave test:

1. Follow the directions provided by the DUT equipment manufacturer to connect the ECG leads from the ECG monitor to the Analyzer.
2. Click **Start** in the **TEST GUIDE** toolbar.
3. Check whether the ECG monitor responds correctly based on the settings being used for the test.
4. If the test duration is set to run indefinitely, click **Stop** in the **TEST GUIDE** toolbar to conclude the test.
5. Click the **Test passed** checkbox or the **Test failed** checkbox to record the observed result of the test.

ECG Noise Immunity Test

The ECG Noise Immunity test checks the ability of the ECG monitor to reject AC line frequency noise.

To run an ECG Noise Immunity test:

1. Follow the directions provided by the DUT equipment manufacturer to connect the ECG leads from the ECG monitor to the Analyzer.
2. Click **Start** in the **TEST GUIDE** toolbar.
Check the ECG monitor for any 50 Hz or 60 Hz interference.
3. Click **Stop** in the **TEST GUIDE** toolbar to conclude the test.
4. Click the **Test passed** checkbox or the **Test failed** checkbox to record the observed result of the test.

Battery Performance Tests

The battery performance tests are used to verify the condition of the defibrillator battery.

Battery Capacity Test

The Battery Capacity test can be used to check whether a battery-powered defibrillator can deliver a certain number of discharges per minute and whether or not the charge time remains adequate throughout the test.

To run a Battery Capacity Test:

1. Connect the defibrillator to the Analyzer.
2. Set the defibrillator to the energy level indicated in the information block in the right pane of the **TEST GUIDE** window.
3. Click **Start** in the **TEST GUIDE** toolbar to start the test. A progress window displays “**Please wait...**” while Ansur configures the Analyzer.
Once configuration completes its routines, the **TEST GUIDE** starts a five-second countdown, after which it displays an instructional message, stating “**Charge and Discharge (n) times within (t) seconds....**” The n represents the actual number of times (n), and the t represents the actual time period recommended.
4. Follow the instructions in the message and begin charging the defibrillator.
5. When charging is complete, discharge the defibrillator. The first test result briefly appears in the right pane of the **TEST GUIDE** window. A new countdown timer message appears in the **Test results** pane, showing the time remaining before the next charge/discharge cycle.
6. Wait for the countdown to conclude.
7. Repeat steps 4 through 6 until the test is completed.
8. To abort the text, click **Stop** in the **TEST GUIDE** toolbar.
9. When the test is fully complete, the measurement results display in the **Test results** pane.

Defib Pulse Repetition Test

The Defib Pulse Repetition test is used to determine if a battery-powered defibrillator can deliver a specified number of discharges within a specified amount of time.

To run a Defib Pulse Repetition test:

1. Connect the defibrillator to the Analyzer.
2. Set the defibrillator to the energy level indicated in the information block in the right pane of the **TEST GUIDE** window.
3. Click **Start** in the **TEST GUIDE** toolbar to start the test. A progress window displays “**Please wait...**” while Ansur configures the Analyzer.
4. When configuration is complete, a prompt displays to repeatedly charge and discharge the defibrillator, along with a countdown timer showing the amount of time available to complete the test..
5. Discharge the defibrillator. Results briefly appear in the right pane of the **TEST GUIDE** window.
6. Continue to charge and discharge the defibrillator for the remaining specified cycles or until the countdown timer reaches zero.
7. Click **Stop** in the **TEST GUIDE** toolbar to abort the test.
8. When the test is complete, the measurement results display in the **Test results** pane.

Chapter 4

Impulse 6000D/7000DP Test Templates

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Introduction

This chapter introduces the template capabilities of the Impulse 6000D/7000DP Plug-In and provides guidance for customizing test templates.

Detailed detailed information on creating Ansur test templates can be found in the *Ansur Test Executive User Manual*.

Creating Test Templates

Create, modify, and review test templates using the Ansur **Main Application** window as a template editor. The Impulse 6000D/7000DP Plug-In provides 16 test elements that are used to build new test procedures. These are accessible in **Test Explorer** and are coded as follows:

- Light blue icon – the Analyzer automatically provides test result data to Ansur as the test is completed.
- Yellow icon – resultant data must be manually entered into Ansur by the user.

To build a test template, take the following actions, beginning from the **Main Application** window:

1. Drag a test element from the **Test Explorer** (left pane) into the **Test Template** (right pane), as displayed in Figure 4-1. Clicking the test element in the **Test Template** highlights the test element and its properties. In this illustration, the highlighted element is the **Impulse 6000D/7000DP Energy Measurement Test**, the first test step to be performed.

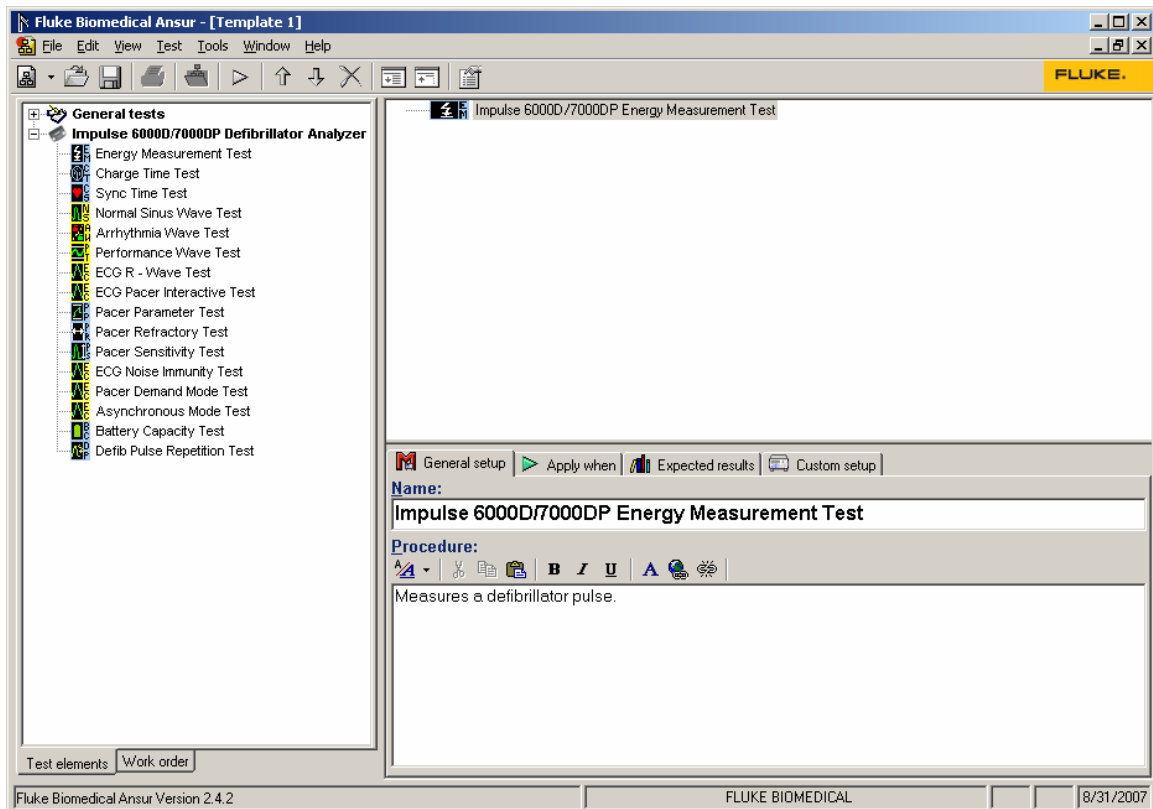


Figure 4-1. Test Template with Selected Test Element

In the middle of the **Test Template** window are located the following tabs to allow definition of the properties of the highlighted test element.

- **General setup**
- **Apply when**
- **Expected results**
- **Custom setup**

Test element properties consist of multiple pages, described below.

2. Click the **General setup** tab. A screen opens, allowing entry of a name for the test. See Figure 4-2. In the space below the name, enter the procedures and instructions to be followed when conducting the test.

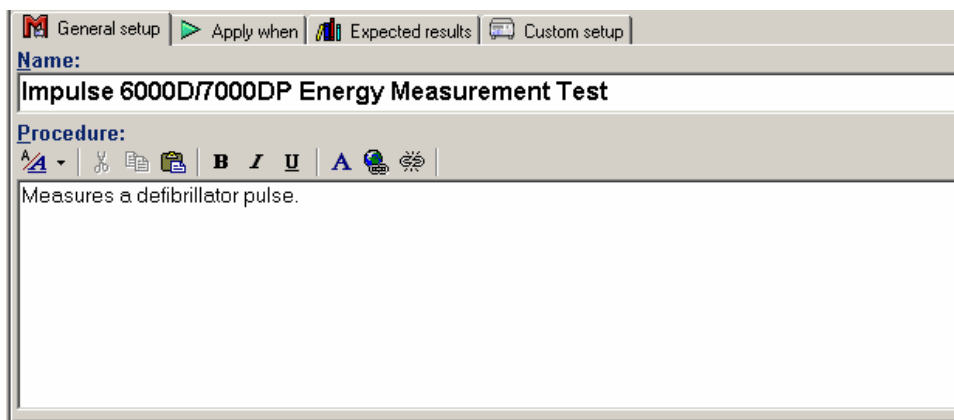


Figure 4-2. User-Definable Parts of the General Setup Tab

fcz09.bmp

3. Click the **Apply when** tab to assign report levels, standards, and service events to test elements. For more information about this feature, see the *Ansur Test Executive User Manual*.
4. Click the **Expected results** tab to view or change the measurement limits for tests, as shown in Figure 4-3.

Note

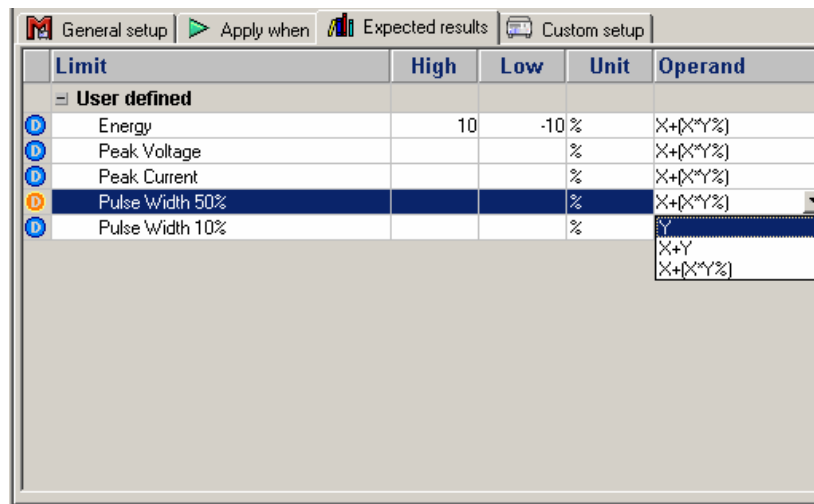
The **Expected results** page is unavailable when test elements do not return measurement data.

Limit	High	Low	Unit	Operand	Reference	Measurement
User defined						
Energy	10	-10 %		X+[XY%]		
Peak Voltage			%	X+[XY%]		
Peak Current			%	X+[XY%]		
Pulse Width 50%			%	X+[XY%]		
Pulse Width 10%			%	X+[XY%]		

Figure 4-3. Expected Results Options for User Input

fcz10.bmp

5. To define how Ansur calculates the limit values for certain measurements, click the **Operand** field to open a drop-down menu, as shown in Figure 4-4.



fcz11.bmp

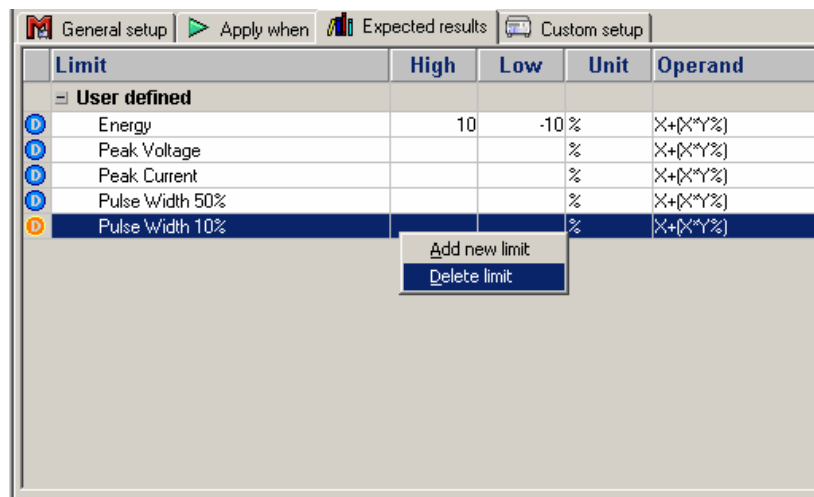
Figure 4-4. Changing the Operand in Expected Results

The operand can be set to any of the following:

- Y – an absolute value
- X + Y – an offset where the limit is calculated as preset value + specified limit
- X + (X * Y%) – calculated as a percentage deviance from the preset value

When the operand is not an absolute limit, the **D** (dynamic) icon appears in the left column, as shown in Figure 4-4. This icon indicates that the limit will be calculated when the test is run.

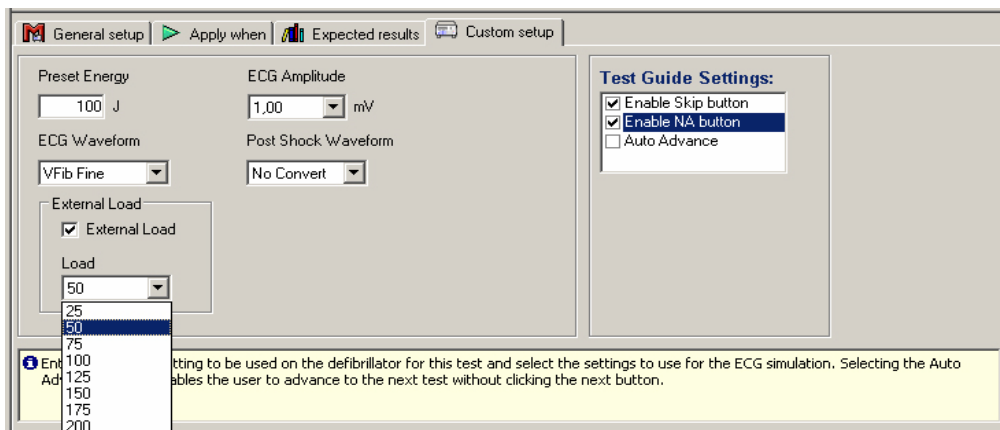
6. To add or delete limits, right click one of the rows of the **Expected results** page and select from the pop-up menu, as shown in Figure 4-5.



fcz12.bmp

Figure 4-5. Add or Delete Limits Pop-up Menu

7. Click the **Custom setup** tab to view and define the parameters used in tests. Test elements have unique custom setups for the capabilities they provide. An example is shown in Figure 4-6.



fcz13.bmp

Figure 4-6. Custom Setup Page for Pacer Parameter Test Element

8. If desired, deselect (uncheck) either or both of the **Test Guide Settings** checkboxes to disable the **Skip** and **NA** button options.

The **Test Guide Settings** control whether certain test elements can be skipped altogether or marked as Not Applicable (NA) while the tests run. The **Skip** and **NA** buttons, shown below, are enabled by default. If a setting is *enabled*, the corresponding **Skip** or **NA** button is available on the toolbar.



eur022.bmp

Defibrillator tests also have available the **Auto Advance** option that is disabled by default. This option advances the **Test Guide** to the next defibrillator test step automatically. If this option is selected for a test element, the field user does not have to click the **Start** button on the **Test Guide** toolbar to start the test or click the **Next** button to advance to the next test step.

Note

The **Auto Advance** option will not resume after a failed test step

Using Defibrillator Test Elements

The defibrillator test elements contained in the Impulse 6000D/7000DP Plug-In are designed to test specific aspects of a defibrillator. This section describes the parameters that can be customized for each test element and the measurement data they provide.

Energy Measurement Test

The Energy Measurement test provides data related to the discharge of a defibrillator and verifies the accuracy of the energy level being delivered. The test provides the measurements listed in Table 4-1 and uses the custom setup parameters that are shown in Table 4-2.

Note

*This test element supports the **Auto Advance Test Guide Setting**.*

Table 4-1. Energy Measurement Test Measurements

Measurement	Unit of Measure	Description
Energy	Joules	Amount of energy discharged by the defibrillator
Peak Voltage	Volts	Peak voltage detected during the discharge
Peak Current	Amperes	Peak current detected during the discharge
Pulse Width 50%	milliseconds	The width of the pulse at 50% of its peak
Pulse Width 10%	milliseconds	The width of the pulse at 10% of its peak

Table 4-2. Energy Measurement Test Custom Parameters

Parameter	Description
Preset Energy	The energy (in Joules) used for the test The field user is prompted to set the defibrillator to this value.
ECG Waveform	The ECG waveform that the Analyzer should simulate during the test

Charge Time Test

The Charge Time test measures how long a defibrillator takes to charge up to a specified energy level. Typically, this test uses as a parameter the maximum energy level available to the defibrillator. Table 4-3 lists the measurements taken for this test. Custom parameters available for the Charge Time tests are listed in Table 4-4.

Note

*This test element supports the **Auto Advance Test Guide Setting**.*

Table 4-3. Charge Time Test Measurements

Measurement	Unit of Measure	Description
Charge Time	seconds	How long it took for the defibrillator to charge to the preset energy specified.
Energy	Joules	Amount of energy discharged by the defibrillator
Peak Voltage	Volts	Peak voltage detected during the discharge
Peak Current	Amperes	Peak current detected during the discharge
Pulse Width 50%	milliseconds	The width of the pulse at 50% of its peak
Pulse Width 10%	milliseconds	The width of the pulse at 10% of its peak

Table 4-4. Charge Time Test Custom Parameters

Parameter	Description
Preset Energy	The energy (in Joules) used for the test The field user is prompted to set the defibrillator to this value.
ECG Waveform	The ECG waveform that the Analyzer should simulate during the test

Synchronization Time Test

The Synchronization Time test determines the ability of the defibrillator to synchronize the discharge of its output pulse with the simulated ECG waveform generated by the Analyzer. Synchronization Time test measurements are listed in Table 4-5. The Synchronization Time test custom parameters are shown in Table 4-6.

Note

*This test element supports the **Auto Advance Test Guide Setting**.*

Table 4-5. Synchronization Time Test Measurements

Measurement	Unit of Measure	Description
Sync Time	seconds	The delay between the top of the ECG wave and the discharging of the defibrillator pulse
Energy	Joules	Amount of energy discharged by the defibrillator
Peak Voltage	Volts	Peak voltage detected during the discharge
Peak Current	Amperes	Peak current detected during the discharge
Pulse Width 50%	milliseconds	The width of the pulse at 50% of its peak
Pulse Width 10%	milliseconds	The width of the pulse at 10% of its peak

Table 4-6. Synchronization Time Test Custom Parameters

Parameter	Description
ECG Waveform	The ECG waveform the Analyzer should simulate during the test
Preset Energy	The energy (in Joules) used for the test The field user is prompted to set the defibrillator to this value.

Using Pacemaker Test Elements (Impulse 7000DP only)

Pacemaker tests confirm the basic operation of external transcutaneous pacemakers by measuring various pacemaker outputs and timing. These tests do not operate with the Impulse 6000D analyzer.

Pacer Parameter Test

The Pacer Parameter test provides data about the accuracy of a pacer's output. Tables 4-7 and 4-8 list the Pacer Parameter test measurements and custom parameters.

Table 4-7. Pacer Parameter Test Measurements

Measurement	Unit of Measure	Description
Pacer Rate	Pulses/minute	Number of pacer pulses detected by the Analyzer during the test
Pulse Amplitude	milliamperes	Peak current detected during the test
Pulse Width	milliseconds	Pacer pulse width as measured by the Analyzer
Pacer Energy	millijoules	Pacemaker energy output

Table 4-8. Pacer Parameter Test Custom Parameters

Parameter	Description
Input Jacks	Specifies where the pacer leads are attached on the Impulse 7000DP Choose between pacer jacks or defib jacks.
Pacer Load	Defines load used for the test If defib jacks are used for the test, a 50 Ω load is used.
Brand	The brand of defibrillator/pacer being tested can be specified to optimize the accuracy of the test.
DUT Rate	Expected pacer rate; field user prompted to set pacemaker to this rate
DUT Amplitude	Expected pacer amplitude; field user prompted to set the pacemaker output current to this value

Pacer Refractory Test

The Pacer Refractory test checks the ability of the pacemaker to interact with cardiac activity when the pacemaker is in demand mode. Ansur retrieves the Pulsed Refractory Period (PRP) and the Sensed Refractory Period (SRP) timings as measured by the Analyzer. Tables 4-9 and 4-10 list the Pacer Refractory test measurements and custom parameters.

Table 4-9. Pacer Refractory Test Measurements

Measurement	Unit of Measure	Description
Sensed Rp	milliseconds	Sensed Refractory Period: period of time that immediately follows sensing of cardiac activity during which time the pacemaker does not sense further cardiac activity The Analyzer measures SRP from the peak of the first ECG R-wave complex to the next ECG R-wave complex following pacemaker pulse.
Paced Rp	milliseconds	Pulsed Refractory Period: period of time immediately following pacemaker pulse during which time the pacemaker senses no cardiac activity and its output is not inhibited The Analyzer measures PRP from the leading edge of the pacemaker pulse to the peak of the first ECG R-wave complex.

Table 4-10. Pacer Refractory Test Custom Parameters

Parameter	Description
Input Jacks	Specifies where the pacer leads are attached on the Impulse 7000 Choose between pacer jacks or defib jacks.
Pacer Load	Defines load used for the test If defib jacks are used for the test, a 50 Ω load is used.
Brand	The brand of defibrillator/pacer being tested can be specified to optimize the accuracy of the test.
DUT Rate	Expected pacer rate; field user prompted to set pacemaker to this rate
DUT Amplitude	Expected pacer amplitude; field user prompted to set the pacemaker output current to this value

Pacer Sensitivity Test

The Pacer Sensitivity test determines the threshold of ECG amplitude required to trigger the pacemaker. Tables 4-11 and 4-12 list the Pacer Sensitivity test measurements and custom parameters.

Table 4-11. Pacer Sensitivity Test Measurements

Measurement	Unit of Measure	Description
Sensitivity Threshold Amplitude	millivolts	The ECG amplitude that triggers the pacer

Table 4-12. Pacer Sensitivity Test Custom Parameters

Parameter	Description
Input Jacks	Specifies where the pacer leads are attached on the Impulse 7000DP Choose between pacer jacks or defibrillator jacks.
Pacer Load	Defines load used for the test If defibrillator jacks are used for the test, a fixed 50 Ω load is used.
Brand	The brand of defibrillator/pacer being tested can be specified to optimize the accuracy of the test.
DUT Rate	Expected pacer rate; field user prompted to set pacemaker to this rate
DUT Amplitude	Expected pacer amplitude; field user prompted to set the pacemaker output current to this value
Waveform Type	The type of ECG waveform output to generate during the test
Waveform Width	The width of each waveform pulse
Waveform Polarity	The ECG waveform polarity that can be specified

ECG Pacer Interactive Test

The ECG Pacer Interactive test simulates a patient response to a pacemaker. Table 4-13 lists the ECG Pacer Interactive custom test parameters.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-13. ECG Pacer Interactive Test Custom Parameters

Parameter	Description
Response Waveform	<p>The type of patient response to simulate:</p> <ul style="list-style-type: none"> • Demand: Normal sinus rhythm at specified rate. Pacer in demand mode can interact so it paces when the normal rate is too slow. Heart responds to pacer pulses at or above threshold. • Asystole: No heartbeat, but heart responds to pacer pulses at or above threshold. • Non-capture: Same as Asystole, but heart fails to respond to one out of every ten pacer pulses. • Non-function: No heartbeat and no response to pacing.
Rate	Beats per minute to use for the Demand Response Waveform
Duration	<p>How long the simulation should last</p> <p>Setting can range from 1 to 60 seconds. If the “Indefinite” checkbox is checked, the duration is ignored, and the test must be manually stopped by the field user (Stop in TEST GUIDE toolbar).</p>
Response Threshold	The level of pacing current required to generate a heart response

Pacer Demand Mode Test

The Pacer Demand Mode test is used to verify demand mode pacing over a range of BPM rates. This test is conducted as a pass/fail test. Table 4-14 lists the custom parameters used for the Pacer Demand Mode test.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-14. Pacer Demand Mode Test Custom Parameters

Parameter	Description
Input Jacks	Specifies where the pacer leads are attached on the Impulse 7000DP Choose between pacer jacks or defib jacks.
Pacer Load	Defines load used for the test If defib jacks are used for the test, a 50 Ω load is used.
Brand	The brand of defibrillator/pacer being tested can be specified to optimize the accuracy of the test
DUT Rate	Expected pacer rate; field user prompted to set pacemaker to this rate
DUT Amplitude	Expected pacer amplitude; field user prompted to set the pacemaker output current to this value
ECG Simulation	This group of parameters establishes a range of BPM values that the test cycles through. The Starting Rate sets the BPM for the start of the test. The Duration Per Step indicates how long the starting rate is used. At the end of the duration time, the BPM is adjusted by the amount specified in the Auto Increment / Decrement Amount parameter The test concludes when the Ending Rate has been reached.

Asynchronous Mode Test

The Asynchronous Mode Test element requires the same parameters as the Pacer Demand Mode Test, but this test element is used for testing a non-demand mode pacer. Refer to table 4-14 for the list of custom parameters that this test uses.

Using ECG Waveform Simulation Test Elements

Normal Sinus Wave Simulation

The Analyzer can generate a normal sinus wave between 10 and 360 beats per minute for output to a defibrillator monitor. Table 4-15 lists the custom parameters for this simulation.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-15. Normal Sinus Wave Simulation Test Custom Parameters

Parameter	Description
ECG Amplitude	The voltage amplitude to use during the simulation of the normal sinus wave
Normal Sinus Waveform BPM	The BPM rate to use for the test
Duration	How long the simulation should last Setting can range from 1 to 60 seconds. If the “Indefinite” checkbox is checked, the duration is ignored, and the test must be manually stopped by the field user (Stop in TEST GUIDE toolbar).

Arrhythmia Wave Test

This test is typically used to verify the shock advisory capability of a defibrillator in response to various arrhythmia waveforms. Table 4-16 lists test custom parameters.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-16. Arrhythmia Wave Advisory Test Custom Parameters

Parameter	Description
Arrhythmia	Selects the category of arrhythmia waveform to use for the test
Arrhythmia Type	Selects the type of arrhythmia to simulate
Poly VTach Type	Provides a choice of 5 types of Poly VTach waveforms when this type of arrhythmia is selected
Mono VTach Rate	BPM value is required when Mono VTach Rate is selected.
ECG Amplitude	The voltage amplitude to use for the arrhythmia simulation
Duration	How long the simulation should last Setting can range from 1 to 60 seconds. With checkbox Indefinite selected, duration is ignored, and the test must be manually stopped by the field user (Stop in TEST GUIDE toolbar).
Atrial Width, Amplitude, and Polarity	These atrial parameters are needed for some TV Paced arrhythmia simulations.
Ventricular Width, Amplitude, and Polarity	These ventricular parameters are needed for some TV Paced arrhythmia simulations.

Performance Wave Simulation

The Performance Wave simulation can be used to test the integrity of a defibrillator monitor with a variety of additional waveform shapes, such as square, triangle, sine, and pulse. Table 4-17 lists the custom parameters for this simulation.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-17. Performance Wave Simulation Test Custom Parameters

Parameter	Description
ECG Amplitude	Indicates the amplitude that the waveform should have
Performance Wave	Selects the type of Waveform to use for the test Choices are: <ul style="list-style-type: none"> • Square: 0.125 or 2 Hz • Pulse: 30 or 60 BPM • Sine: 0.05, 0.5, 10, 40, 50, 60, 100, 150, 200 Hz • Triangle: 2 or 2.5 Hz
Duration	How long the simulation should last Setting can range from 1 to 60 seconds. If checkbox Indefinite is selected, duration is ignored, and the user must stop the test manually (Stop in TEST GUIDE toolbar).

ECG R-Wave Test

The ECG R-Wave test checks the ability of the ECG monitor to detect an R-Wave over a range of R-Wave widths and amplitudes. Table 4-18 lists the custom parameters used by the ECG R-Wave test.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-18. ECG R-Wave Test Custom Parameters

Parameter	Description
ECG Amplitude	Indicates the amplitude that the waveform should have
Performance Wave	Selects the type of Waveform to use for the test Choices are: <ul style="list-style-type: none"> • Square: 0.125 or 2 Hz • Pulse: 30 or 60 BPM • Sine: 0.05, 0.5, 10, 40, 50, 60, 100, 150, 200 Hz • Triangle: 2 or 2.5 Hz
Duration	How long the simulation should last Setting can range from 1 to 60 seconds. If checkbox Indefinite is selected, duration is ignored, and the user must stop the test manually (Stop in TEST GUIDE toolbar).

ECG Noise Immunity Test

The ECG Noise Immunity test checks the ability of the ECG monitor to reject AC line frequency noise. The custom parameters for this test are listed in table 4-19.

Note

This is a visual / audible test; the Analyzer takes no measurements during this test.

Table 4-19. ECG Noise Immunity Test Custom Parameters

Parameter	Description
Noise Amplitude	Indicates the amplitude for the waveform
Line Frequency	Selects 50 Hz or 60 Hz line noise simulation
ECG Wave	Option to include an ECG Wave during the test

Using Battery Performance Test Elements

Battery Capacity Test

The Battery Capacity test is used to check whether a battery-powered defibrillator can deliver a certain number of discharges per minute and whether the charge time remains adequate throughout the test. Tables 4-20 and 4-21 list the Battery Capacity test measurements and custom parameters.

Table 4-20. Battery Capacity Test Measurements

Measurement	Unit of Measure	Description
Charge Time	seconds	How long it took for the defibrillator to charge to the preset energy specified The test stores multiple charge times – one per discharge.

Table 4-21. Battery Capacity Test Custom Parameters

Parameter	Description
Preset Energy	The energy (in Joules) used for the test The field user is prompted to set the defibrillator to this value.
Discharges/Minute	The number of discharges to be completed each minute The default value of 1 should normally be used.
Total Discharges	The number of discharges to be completed during the test

Defib Pulse Repetition Test

The Defib Pulse Repetition test is used to determine if a battery-powered defibrillator can deliver a specified number of discharges within a specified amount of time. Tables 4-22 and 4-23 list the Defib Pulse Repetition test measurements and custom parameters.

Table 4-22. Defib Pulse Repetition Test Measurements

Measurement	Unit of Measure	Description
Energy	Joules	Amount of energy discharged by the defibrillator The test stores multiple energy measurements – one per discharge.

Table 4-23. Defib Pulse Repetition Test Custom Parameters

Parameter	Description
Preset Energy	The energy (in Joules) used for the test The field user is prompted to set the defibrillator to this value.
Number of Pulses	The number of discharges to be completed during the test
Number of Minutes	The maximum time allowed for this test to be completed

