Operating Manual

GOSSEN METRAWATT

SECULIFE DF$_{BASE}$

DEFIBRILLATOR ANALYZER

3-349-804-03
1/6.14

Contents

WARNING - USERS

The SECULIFE DF_{BASE} analyzer is for use by skilled technical personnel only.

WARNING - USE

The SECULIFE DF_{BASE} Analyzer is intended for testing only and it should never be used in diagnostics, treatment or any other capacity where it would come in contact with a patient.

WARNING - MODIFICATIONS

The SECULIFE DF_{BASE} Analyzer is intended for use within the published specifications. Any application beyond these specifications or any unauthorized user modifications may result in hazards or improper operation.

WARNING - CONNECTIONS

All connections to patients must be removed before connecting the Device Under Test (DUT) to the Analyzer. A serious hazard may occur if the patient is connected when testing with the Analyzer.

Do not connect any leads from the patient directly to the Analyzer or DUT.

WARNING - POWER ADAPTER

Unplug the Power Adapter before cleaning the surface of the Analyzer.

WARNING - LIQUIDS

Do not submerge or spill liquids on the Analyzer. Do not operate the Analyzer if internal components not intended for use with fluids may have been exposed to fluid, as the internal leakage may have caused corrosion and be a potential hazard.

CAUTION - SERVICE

The SECULIFE DF$_{BASE}$ Analyzer is intended to be serviced only by authorized service personnel. Troubleshooting and service procedures should only be performed by qualified technical personnel.

CAUTION - ENVIRONMENT

The SECULIFE DF$_{BASE}$ Analyzer is intended to function between 15 and 40 °C.Exposure to temperatures outside this range can adversely affect the performance of the Analyzer.

CAUTION - CLEANING

Do not immerse. The Analyzer should be cleaned by wiping gently with a damp, lint-free cloth. A mild detergent can be used if desired.

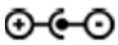
CAUTION - INSPECTION

The SECULIFE DF$_{BASE}$ Analyzer should be inspected before each use for wear and the Analyzer should be serviced if any parts are in question.

NOTICE – INDICATIONS FOR USE

The SECULIFE DF$_{BASE}$ Analyzer is used to determine that defibrillators and transcutaneous pacemakers are performing within their performance specifications through the measurement of energy output.

NOTICE – SYMBOLS

Symbol	Description
	Caution (Consult Manual for Further Information)
	Hazardous Voltage
	Center Negative
	Direct Current
	Per European Council Directive 2002/95/EC, do not dispose of this product as unsorted municipal waste.
	Conforms to European Union directives
CAT I	IEC Measurement Category I – CAT I equipment designed to protect against transients in equipment on circuits not directly connected to MAINS. Under no circumstances should the terminals of the Analyzer be connected to any MAINS voltage

NOTICE – ABBREVIATIONS

A, Amps	**Amperes**
BPM	**Beats Per Minute**
c	**centi- (10^{-2})**
C	**Celsius**
°	**degree**
dt	**Delta Time, Change in Time**
DUT	**Device Under Test**
E	**Energy**
ECG	**Electrocardiogram**
Euro	**European**
Hz	**hertz[3])**
kg	**kilograms**
lbs	**pounds**
µ	**micro- (10^{-6})**
µA	**microampere**
µH	**microhertz**
µV	**microvolt**
µsec	**microsecond**
m	**milli- (10^{-3})-**
mA	**milliampere**
mm	**millimeter**
ms, mS, msec	**millisecond**
mV	**millivolts**
Ω	**ohm**
P	**Power**
ppm	**pulse per minute**
R	**Resistance, ohms**
Sec, S	**seconds**
US	**United States**
V	**volt**
VDC	**Direct Current Voltage**

CE

EG - KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

GMC-I MESSTECHNIK

Dokument-Nr./ Document.No.:	820 / 11-016
Hersteller/ Manufacturer:	GMC-I MESSTECHNIK GMBH
Anschrift / Address:	Südwestpark 15 D - 90449 Nürnberg
Produktbezeichnung/ Product name:	Defibrillator Analyzer Defibrillator Analyzer
Typ / Type:	SECULIFE DF+ /DFBase
Bestell-Nr / Order No:	M695A /Q

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinien überein, nachgewiesen durch die vollständige Einhaltung folgender Normen:

The above mentioned product has been manufactured according to the regulations of the following European directives proven through complete compliance with the following standards:

Nr. / No.	Richtlinie	Directive
2006/95/EG 2006/95/EC	Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen - Niederspannungsrichtlinie – Anbringung der CE-Kennzeichnung : 2014	Electrical equipment for use within certain voltage limits - Low Voltage Directive - Attachment of CE mark : 2014

EN/Norm/Standard	IEC/Deutsche Norm	VDE-Klassifikation/Classification
EN 61010-1 : 2010	IEC 61010-1 : 2010	VDE 0411-1 : 2011

Nr. / No.	Richtlinie	Directive
2004/108/EG 2004/108/EC	Elektromagnetische Verträglichkeit - EMV Richtlinie -	Electromagnetic compatibility - EMC directive -

Produktfamiliennorm / Product family standard

EN 61326-1 : 2006

Nürnberg, den 24.06.2014
Ort, Datum / Place, date:

Geschäftsführung / managing director

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentationen sind zu beachten.

This declaration certifies compliance with the above mentioned directives but does not include a property assurance. The safety notes given in the product documentations, which are part of the supply, must be observed.

----------Vorlage: FC8F29 -10.08----------Datei : 11 Steuerdatei Sparte PM.doc

NOTICE – DISCLAIMER

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DEFIBRILLATOR ANALYZER

SECULIFE DF_{BASE} is a microprocessor-based instrument that is used in the testing of defibrillators. It measures the energy output and provides information about the defibrillation pulse. It is used on manual, semi-automatic and automatic defibrillators with monophasic or biphasic outputs.

SECULIFE DF_{BASE} additionally provides a Transcutaneous Pacemaker analysis function. It measures and displays pacer pulse information as well as performing Refractory Period, Sensitivity and Immunity testing.

It has a built in 50 ohm human body simulation load as well as 12 lead ECG with arrhythmias and performance waveforms. Additionally, it has a Centronics printer port, a serial port, oscilloscope output, high-level ECG output, as well as provision for a battery eliminator.

SECULIFE DF_{BASE} makes viewing and selecting the desired waveforms and test data quick and intuitive, with all operational information being available on the 240 by 64 pixel graphic display, allowing for easy maneuvering through parameters and scrolling through available options.

NOTE
This instrument is intended for use by Trained Service Technicians.

The following are highlights of some of the main features:

GENERAL

- SIMPLE TO OPERATE
- GRAPHICS DISPLAY WITH SIMULTANEOUS DETAILED STATUS OF PARAMETERS AND SCROLLING CONTROL OF OPTIONS
- ON SCREEN VIEWING OF DEFIBRILLATOR AND PACEMAKER WAVEFORMS
- DROP DOWN CHOICE SCREENS LIST ALL OPTIONS FOR PARAMETERS
- MONOPHASIC AND BIPHASIC COMPATIBLE
- 5000 V, 1000 JOULE CAPACITY
- HIGH AND LOW RANGES
- CARDIOVERSION DELAY MEASUREMENT
- CHARGE TIME MEASUREMENT
- WAVEFORM STORAGE AND PLAYBACK
- 10 UNIVERSAL PATIENT LEAD CONNECTORS
- 25 PIN CONNECTOR FOR CENTRONICS PRINTER
- 9 VOLT BATTERY POWER
- LOW BATTERY INDICATOR
- AVAILABLE BATTERY ELIMINATOR
- DISPLAY BACKLIGHT
- FULL REMOTE OPERATION VIA RS-232
- FLASH PROGRAMMABLE FOR UPGRADES
- AUTO SEQUENCE TESTING CAPABLE OF STORING 50 CUSTOM TEST SEQUENCES

ENERGY OUTPUT MEASUREMENT GENERAL

The unit measures the energy in the output pulse of both monophasic and biphasic defibrillators.

- PULSE TYPE: Monophasic or Biphasic
- LOAD RESISTANCE: 50 ohm +/- 1%, non-inductive (<1 µH)
- DISPLAY RESOLUTION: 0.1 Joules
- MEASUREMENT TIME WINDOW: 100 ms
- ABSOLUTE MAX PEAK VOLTAGE: 6000 Volts
- CARDIOVERSION DELAY: 0 to 6000 ms
- CARDIOVERSION RESOLUTION: 0.1 ms

ENERGY OUTPUT MEASUREMENT HIGH RANGE

The high range allows for a large pulse with high voltage and current.

- VOLTAGE: ≤5000 Volts
- MAX CURRENT: 100 Amps
- MAX ENERGY: 1000 Joules
- TRIGGER LEVEL: 100 Volts
- PLAYBACK AMPLITUDE: 1 mV / 1000 V Lead I
- TEST PULSE: 125 Joules +/- 20%

ENERGY OUTPUT MEASUREMENT LOW RANGE

The low range allows greater resolution on smaller pulses.

- VOLTAGE: <1000 Volts
- MAX CURRENT: 20 Amps
- MAX ENERGY: 50 Joules
- TRIGGER LEVEL: 20 Volts
- PLAYBACK AMPLITUDE: 1 mV / 1000 V Lead I
- TEST PULSE: 5 Joules +/- 20%

ENERGY OUTPUT MEASUREMENT OTHER

OSCILLOSCOPE OUTPUT

- HIGH MEASUREMENT RANGE: 1000:1 amplitude-attenuated
- LOW MEASUREMENT RANGE: 200:1 amplitude-attenuated

WAVEFORM PLAYBACK

- OUTPUT – LEAD 1 & PLATES
- GRAPHICS SCREEN
- 200:1 Time Base Expansion

SYNC TIME MEASUREMENTS

- TIMING WINDOW: Starts at peak of each R-wave
- TEST WAVEFORMS: All waveform simulations available

CHARGE TIME MEASUREMENT

- From 0 .1 to 99.9 sec

ECG FUNCTIONS

The unit can produce a wide variety of ECG simulations. The user simply selects the parameters that match the desired output.

- RATE: 30,40,45,60,80,90,100,120,140,160,180,200,220,240,260,280,300 BPM
- AMPLITUDE: 0.50,1.0,1.5,2.0 mV (Lead II)

ECG-PERFORMANCE FUNCTIONS

The unit can generate Sine, Square, Triangular, and Pulse waveforms with adjustable amplitudes for performance testing.

- SINE: 0.1,0.2,0.5,5,10,40,50,60,100 Hz
- SQUARE: 0.125,2 Hz
- TRIANGLE: 2,2.5 Hz
- PULSE: 30,60,120 BPM; 60 ms WIDTH
- AMPLITUDE: 0.5,1.0,1.5,2.0 mV (Lead II)

ARRHYTHMIA FUNCTIONS

The unit can simulate 12 different arrhythmias.

- VENTRICULAR FIBRILLATION
- ATRIAL FIBRILLATION
- SECOND DEGREE A-V BLOCK
- RIGHT BUNDLE BRANCH BLOCK
- PREMATURE ATRIAL CONTRACTION
- EARLY PVC
- STANDARD PVC
- R ON T PVC
- MULTIFOCAL PVC
- BIGEMINY
- RUN OF 5 PVC
- VENTRICULAR TACHYCARDIA

SHOCK ADVISORY TESTS

The unit can simulate 8 different waveforms to test the shock algorithm of advanced defibrillators:

- ASYSTOLE
- COARSE VENTRICULAR FIBRILLATION
- FINE VENTRICULAR FIBRILLATION
- MULTIFOCAL VENTRICULAR TACHYCARDIA @ 140 BPM
- MULTIFOCAL VENTRICULAR TACHYCARDIA @ 160 BPM
- POLYFOCAL VENTRICULAR TACHYCARDIA @ 140 BPM
- POLYFOCAL VENTRICULAR TACHYCARDIA @ 160 BPM
- SUPRAVENTRICULAR TACHYCARDIA @ 90 BPM

ACCESSORIES

BC20 - 40032	INTERNAL PADDLE ADAPTERS (2 adapters)
BC20 - 21103	BATTERY ELIMINATOR (120 VAC) (US Version)
BC20 - 21101	BATTERY ELIMINATOR (220 VAC) (Euro Version)
BC20 - 00427	PLASTIC ELECTRODE PLATES (2 plates)

OPTIONAL ACCESSORIES

BC20 - 30108 MEDIUM SOFT SIDED CARRYING CASE BC20 - 41341 COMMUNICATION CABLE (DB 9 M to DB 9 F)

BC20 - 00420 PHYSIO-CONTROL DEFIB / PACE TEST CABLE

BC20 - 00421 MARQUETTE DEFIB / PACE TEST CABLE BC20 - 00423 ZOLL DEFIB/PACE TEST CABLE

BC20 - 00426 HP / AGILENT / LAERDAL / AAMIDEFIB / PACE TEST CABLE

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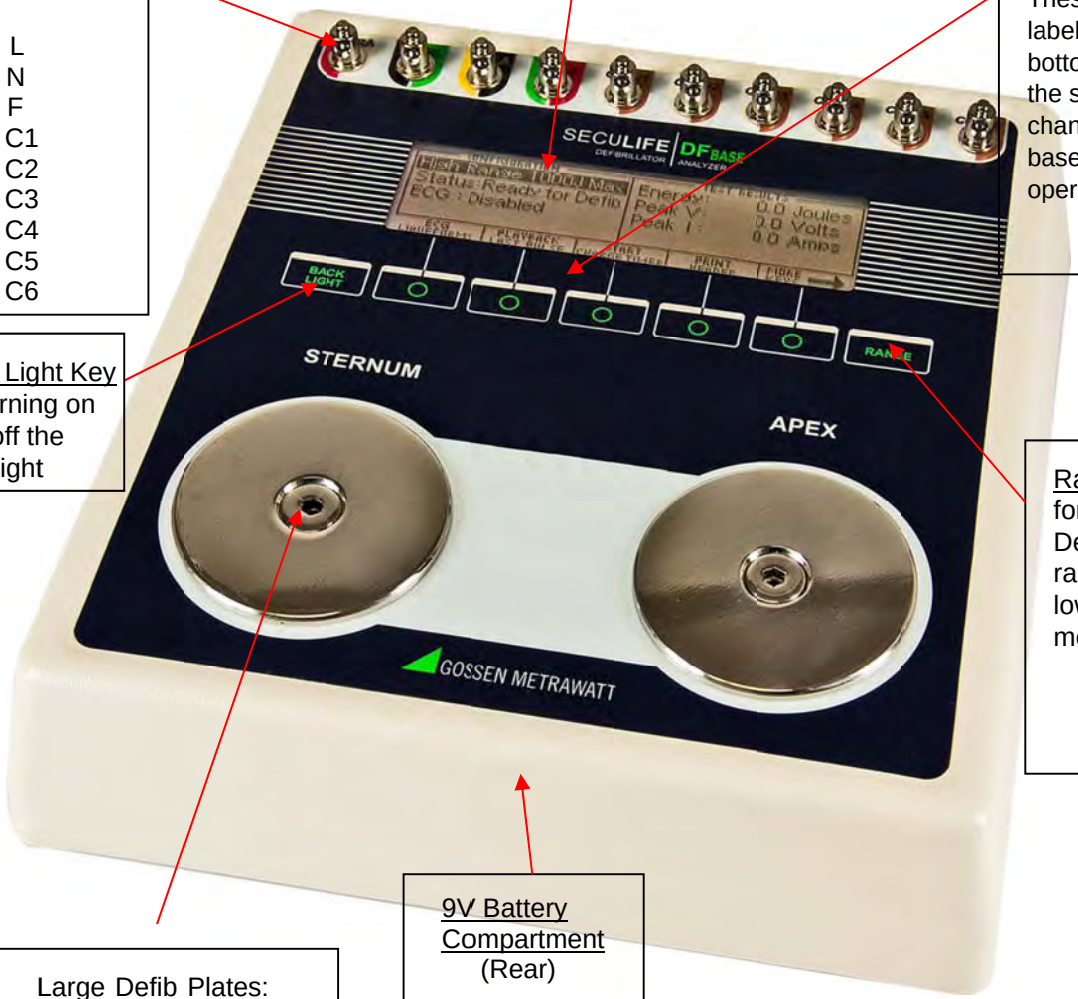
OVERVIEW

This section looks at the layout of SECULIFE DF$_{BASE}$ and gives descriptions of the elements that are present.



LCD Graphical Display:
Shows Parameters for Test Data and Waveforms

10 Universal Patient Lead Connectors:
RA R
LA L
RL(-) N
LL F
V1 C1
V2 C2
V3 C3
V4 C4
V5 C5
V6 C6

5 Light Touch Keys for Dynamic functions:
These keys are labelled in the bottom portion of the screen and change function based on operating mode.

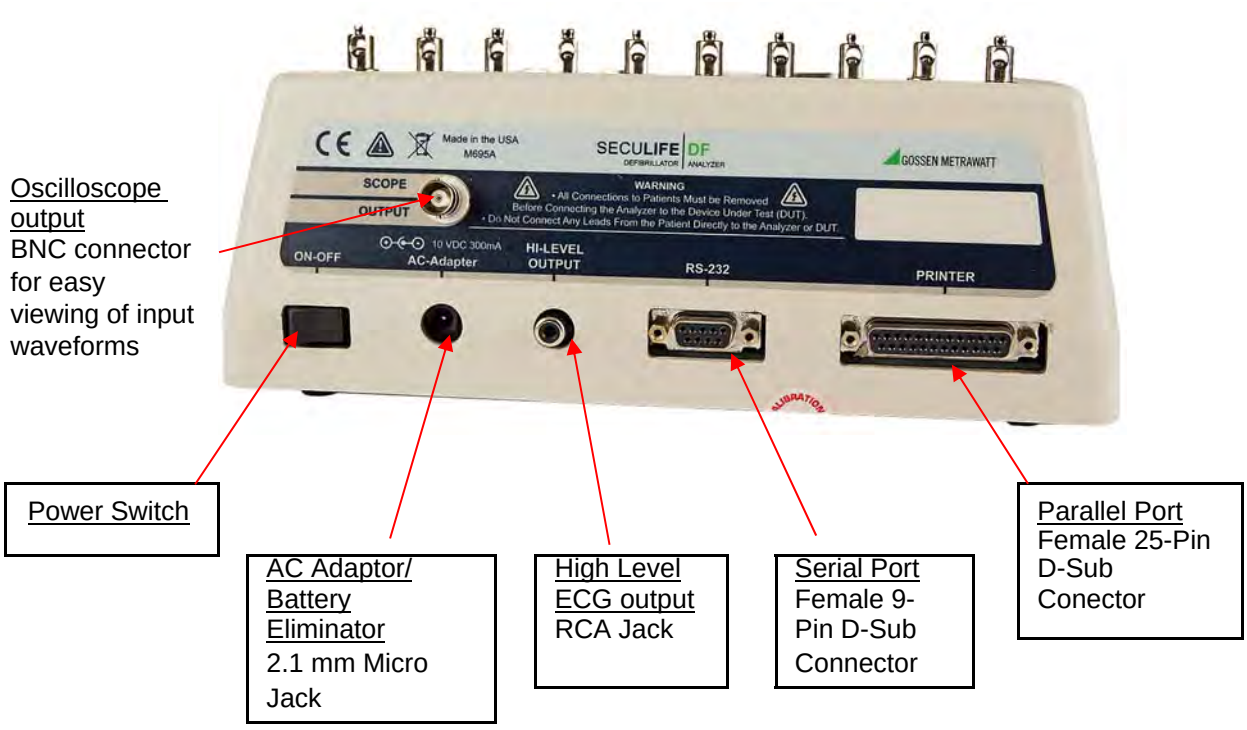
Back Light Key
for turning on and off the backlight

Range Key
for selecting Defib input range high or low and pace mode

9V Battery Compartment
(Rear)

Large Defib Plates:
Fixed 50 ohm input load for Defibrillator testing

This section looks at the layout of the back and gives descriptions of the elements that are present.



General Operation

The unit is controlled by 7 light touch keys. They allow the user to move around within the displayed parameters, select the desired options, choose a specific category and control the setup for the unit. When a key is depressed there is an audio click when it is accepted, or a razz tone if the key is invalid.

A large LCD graphics display with backlight provides the user with information about the current status of the device configuration options, test results and more. The display identifies the function of each key on a dynamic basis. As the operation mode changes, the key functions change to suit the operating mode.

Range Key

The 

key scrolls through the ranges of the SECULIFE DF$_{BASE}$ analyzer. Depressing the key will allow the user to select between High Defibrillator Range (1000J max), Low Defibrillator Range (50J max) and Pacemaker Range. The default mode on power up is High Defibrillator Range.

Backlight Key

The Graphic LCD display may be viewed with or without the backlight. Depressing any key will activate the backlight. However, since the backlight will drain the battery if left on, it will automatically shut off after a user programmable delay when running on battery power.

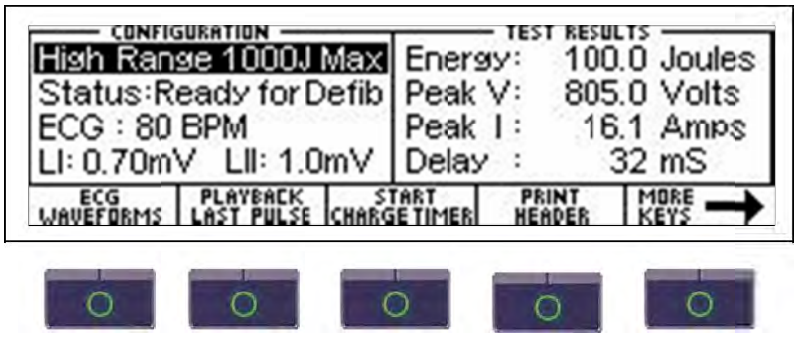
The 

key is provided to toggle the backlight on or off at any time.

Function Keys

There are five  keys that are used to provide general operational control. The functions of the keys vary depending on the current screen. The section of the screen just above the key indicates its current meaning.

NOTE: Only functions that are available to the user will be visible at any given time.



Sample Function Key Labeling

ECG Waveforms

The microprocessor has stored in its memory all of the digitalized waveforms. It sends the waveforms to a D/A converter, which generates an accurate analog representation. The waveform is then sent through resistor networks, developing the appropriate signals on the output terminals.

Universal Patient Lead Connectors

The 10 Universal Patient Lead Connectors allow for 12 lead ECG simulations. AHA and IEC color-coded labels are located on the face of the unit to aid in connecting the corresponding U.S. and International Patient Leads.

AHA Label	IEC Label	Description
RA	R	**Right Arm**
LA	L	Left Arm
RL	N	Right Leg (reference or ground)
LL	F	Left Leg
V1 V2 V3 V4 V5 V6	C1 C2 C3 C4 C5 C6	V Leads (V1-V6) (U.S. and Canada) also referred to as pericardial, precordial or unipolar chest leads Chest Leads (C1-C6) (International)

High Level Output (+)

A high level ECG output signal (200 X Amplitude Setting) is available on the RCA jack located on the rear of the unit.

Serial Port

A female 9-pin D-Sub connector is provided for the connection of the unit to a PC or laptop serial port (e.g. Com 1). This link is then used for either remote control or flash downloading of software upgrades.

Parallel Port

A female 25-pin D-Sub connector is provided for the connection of a printer via a Centronics parallel interface.

Oscilloscope Output

A BNC connector is provided to connect an oscilloscope to the unit. This output is a 200:1 attenuated version of the input to the Defibrillator Plates.

Power Switch

A rocker switch is provided on the rear of the unit to turn the power on and off.

Power Supply

The unit utilizes two 9 Volt Alkaline Batteries in the bottom battery compartments. When the unit detects a LOW BATTERY condition (10% Battery Life), a warning window will appear once per minute to alert the user.

Battery Eliminator

The unit has a 2.1 mm micro jack for connecting a 10-Volt AC battery eliminator. The adapter will power the unit, but will not charge the battery.

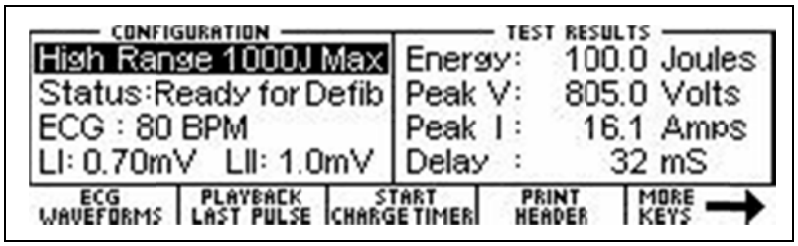
DEFIBRILLATOR ANALYZER

MAIN SCREEN

When the SECULIFE DF$_{BASE}$ is first powered up, the Defibrillator Analyzer MAIN SCREEN will be displayed. This screen shows the current CONFIGURATION, the TEST RESULTS and the available FUNCTION KEYS. All defibrillator tests are run from the MAIN SCREEN. When the unit detects an input of greater than 100 Volts on the Defibrillator Plates (20 Volts in Low Range), it will automatically begin a test.

The default configuration is the High Range Defibrillator mode. This mode allows for a waveform of up to 1000 Joules to be analyzed.

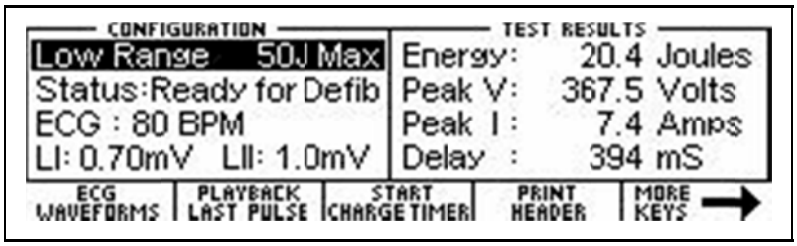
The following is a sample screen for this mode:



The 

key may be used to toggle the unit to the Low Range Defibrillator mode. This mode allows for waveforms up to 50 Joules to be analyzed. The Defibrillator Analyzer works the same in both ranges. The lower range simply provides for a higher resolution for pulses with smaller amplitudes.

The following is a sample screen for this mode:



CONFIGURATION

The CONFIGURATION section of the MAIN SCREEN displays the current setup of the unit.

RANGE

The first line displays the range value for the pulse. It may be either 1000 Joules or 50 Joules max. This setting may be changed using the 

key.

STATUS

This line provides information about the current status of the analyzer.

ECG

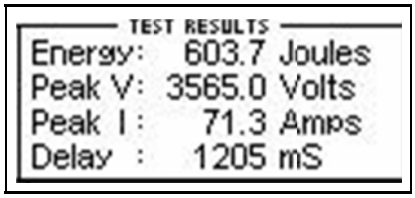
This line displays the selection that is active on the ECG terminals. This setting may be changed in the ECG WAVEFORMS screen.

AMP

This line displays the amplitude that has been selected for the ECG terminals. This setting may be changed in the ECG WAVEFORMS screen.

TEST RESULTS

The TEST RESULTS section of the MAIN SCREEN displays the results of the last pulse. It will continue to be displayed until the power is turned off, another test is run or the range is changed.



NOTE: The unit automatically starts a test when it sees a voltage greater than 100 Volts on the Defibrillator Plates (20 Volts in Low Range).

NOTE: Test results are immediately sent to the printer port as soon as the data is available.

ENERGY

This line displays the total energy of the last pulse.

PEAK V

This line displays the peak voltage of the last pulse.

PEAK I

This line displays the peak current of the last pulse.

DELAY

This line normally displays the delay from the peak of the R wave until the start of the Defib Energy pulse. The line is replaced by the CHARGE TIME if this test has been run (see START CHARGE TIMER SCREEN for more information).

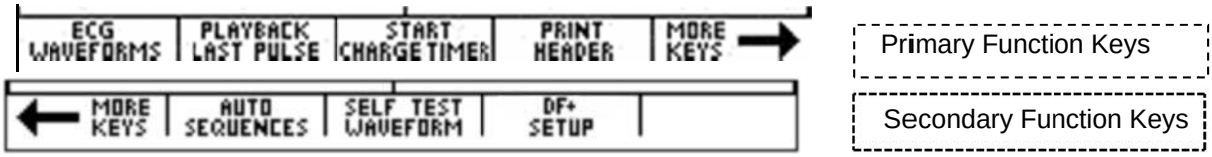
CHG TIME

This line displays if the Charge Timer has been run. It shows the time required to charge the Device Under Test (DUT). This test is started with the 

key.

FUNCTION KEYS

The FUNCTION KEYS section of the MAIN SCREEN displays the current functions of the keys found below the display. These keys allow for navigation to supporting screens and initiation of specific features.



ECG WAVEFORMS

This key enters the ECG WAVEFORMS screen where all ECG parameters are set.

PLAYBACK LAST PULSE

This key enters the PLAYBACK LAST PULSE screen where a graphical representation of the last pulse may be viewed and sent out.

START CHARGE TIMER

This key brings up the CHARGE TIMER screen and starts the pre-warn timer. It is used to test the charge time for the defibrillator.

PRINT HEADER

This key sends the Report Header to the printer.

MORE KEYS

These keys toggle between the Primary and Secondary Function Keys.

AUTO SEQUENCES

This key brings up the AUTO SEQUENCE MENU, which is used to view or run the Auto Sequences stored in the unit.

SELF TEST WAVEFORM

This key sends an internal test pulse to the unit, allowing for the display of the results to give an indication that the system is working properly.

SECULIFE DF$_{BASE}$ SETUP

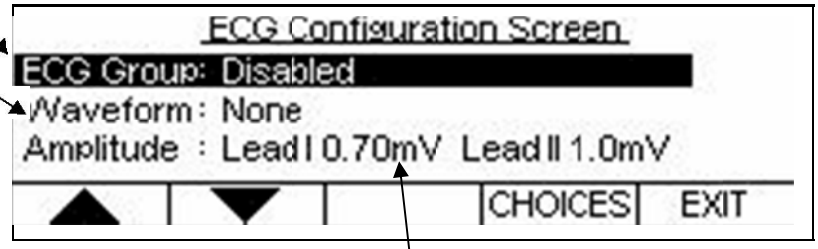
This key brings up the SYSTEM CONFIGURATION SCREEN, which allows for adjusting the various system configuration parameters.

ECG WAVEFORMS SCREEN

The SECULIFE DF$_{BASE}$ ECG output can be connected in 3, 5 or 12 lead configurations.

Pressing the ECG WAVEFORMS key from the MAIN SCREEN will allow the user to configure the waveform that is used for the ECG output.

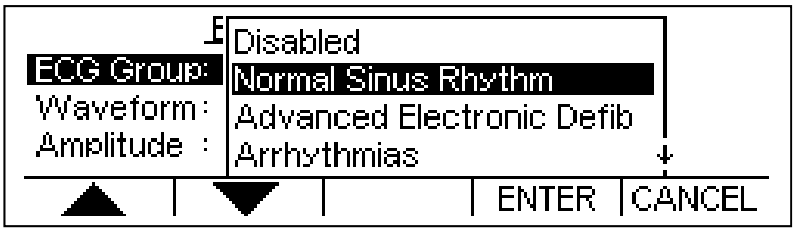
The following is a sample of the ECG waveform configuration screen:



ECG GROUP	WAVEFORM
Disabled	None
NSR	30,40,45,60,80,90, 100,120,140,160, 180,200,220,240, 260,280,300 BPM
AED	Asystole
	Coarse Vfib
	Fine Vfib
	Multifocal Vtach 140
	Multifocal Vtach 160
	Polyfocal Vtach 140
	Polyfocal Vtach 160
	SupraVent Tach 90
Arrhythmias	Vfib
	Afib
	Second Deg Block
	RBBB
	PAC
	PVC Early
	PVC STD
	PVC R on T
	MF PVC
	Bigeminy
	Run of 5 PVC
	Vtach
Performance	0.125, 2 Hz Square
	2, 2.5 Hz Triangle
	0.1,0.2,0.5,5,10,40,50,60,100 Hz Sine
	30, 60, 120 BPM Pulse

AMPLITUDE
Lead I 0.35 mV Lead II 0.5 mV Lead I 0.70 mV Lead II 1.0 mV Lead I 1.05 mV Lead II 1.5 mV Lead I 1.40 mV Lead II 2.0 mV

The ECG Group, Waveform and Amplitude can be selected using ▲▼ to highlight the parameter and using CHOICES to open a drop down menu of all the options for the highlighted parameter.



Use ▲▼ to scroll to the desired option. Then ENTER is used to accept the new setting. The CANCEL key can be used to return to the ECG waveform configuration screen without making a new selection.

The EXIT key is used to return to the MAIN SCREEN.

The following is a brief description of how the SECULIFE DF_{BASE} simulates the available Arrhythmias:

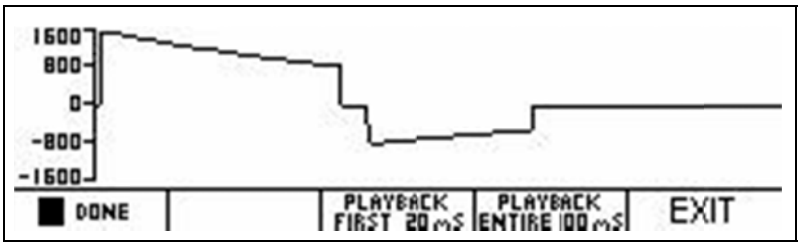
Abbreviation	Arrhythmia	Description
Vent Fib – Fine	Ventricular Fibrillation	Irregular waveform with no real P-wave or clear R-R interval and a low signal level (Continuous)
Atrial Fib	Atrial Fibrillation	Absence of P-wave, irregular P-R interval rate and a high level signal (Continuous)
2nd Deg Heart Block	Second Degree Heart Block	80 BPM with increasing P-R interval for four beats (160, 220, 400, 470 ms) followed by a P wave without a QRS (Continuous)
Rt Bundle Branch Block	Right Bundle Branch Block	80 BPM with Normal P-wave and P-R interval but wider QRS complexes (Continuous)
PAC	Premature Atrial Contraction	NSR of 80 BPM with Periodic Abnormal 25% early P waves (PAC, 7 NSR) (Continuous)
PVC Early	Early Type 1 Premature Ventricular Contraction	NSR of 80 BPM with periodic left focus premature ventricular beats with 33% premature timing (PVC Type 1, 9 NSR) (Continuous)
PVC Std	Standard Type 1 Premature Ventricular Contraction	NSR of 80 BPM with periodic left focus premature ventricular beats with 20% premature timing (PVC Type 1, 9 NSR) (Continuous)
PVC R on T	R on T Type 1 Premature Ventricular Contraction	NSR of 80 BPM with periodic left focus premature ventricular beats with 65% premature timing, placing R on the previous T (PVC Type 1, 9 NSR) (Continuous)
Multifocal PVCS	Multifocal Premature Ventricular Contraction	NSR of 80 BPM with Type 1 and Type 2 PVCs (PVC Type 1, 2 NSR, PVC Type 2, 2 NSR) (Continuous)

Abbreviation	Arrhythmia	Description
Bigeminy	Bigeminal Rhythm	NSR of 80 BPM with every other beat a Type 1 PVC (Continuous)
Run of 5 PVCs	Run of 5 Premature Ventricular Contractions	NSR of 80 BPM with periodic group of 5 Type 1 PVCs (5 PVC Type 1, 36 NSR) (Continuous)
Vent Tach	Ventricular Tachycardia	160 BPM, No P-wave, Beats similar to Type 1 PVC (Continuous)

PLAYBACK LAST PULSE SCREEN

The SECULIFE DF_{BASE} can display a graphical representation of the last pulse. This screen may be accessed by pressing the PLAYBACK LAST PULSE key from the Defibrillator Analyzer MAIN SCREEN. The playback allows the user to view the Defibrillator pulse in a time-expanded form. Samples are stored internally at 0.1 ms intervals. The PLAYBACK LAST PULSE SCREEN shows these samples expanded by a time factor of 200.

In playback mode, the samples are shown on the display and sent out the ECG leads, Defibrillator Plates and the High Level output. The following is a sample of the waveform that is shown in the display:



The scale shown on the screen is automatically adjusted to provide the maximum resolution available.

The PAUSE key can be used to pause the screen at any point while a pulse is being played back. This key replaces the DONE key when a pulse is being played back.

The PLAY key can be used to play (continue) the waveform if it has been paused.
This key replaces the PAUSE key.

The 

key starts a playback of only the first 20 ms of the waveform.

The 

key starts a playback of the entire 100 ms of the waveform.

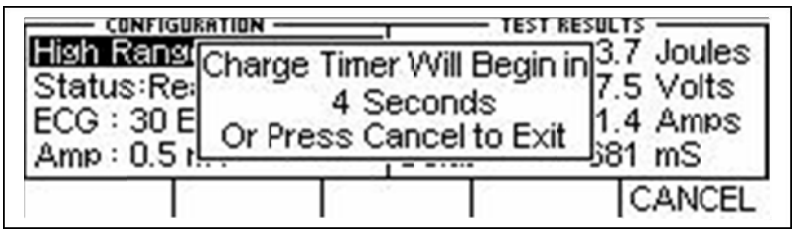
At any time, the 

key or 

key can be depressed to return to the MAIN SCREEN.

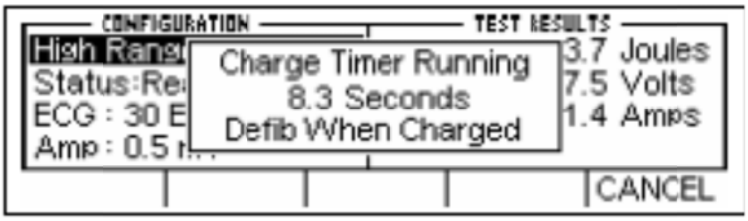
START CHARGE TIMER SCREEN

A special timer has been incorporated into the SECULIFE DF_{BASE} to analyze the charging circuit of the Device Under Test (DUT). The START CHARGE TIMER SCREEN can be accessed by pressing the START CHARGE TIME key from the MAIN SCREEN. To synchronize the charge timer with the defibrillator charge time, a Pre-Warning Countdown period is started. When the timer reaches zero, the defibrillator charge should be initiated. The following is an example of the countdown timer:

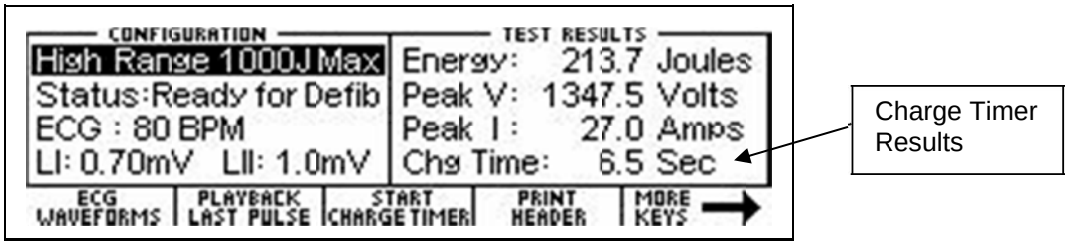


When the timer reaches zero, a beep will sound and the charge timer will begin counting up.

The following is an example of the count up timer:



The DUT should be discharged as soon as it becomes charged. When the DUT is discharged, the timer will automatically stop. The display will show the results of the Defibrillator pulse analysis as well as the time required to charge the DUT:



At any time, the CANCEL key can be depressed to end the timer and return to the MAIN SCREEN.

PRINT HEADER

The SECULIFE DF_{BASE} provides a header for recording test data as well as the results of each pulse that is discharged into the unit. Test results are immediately sent to the printer port as soon as the data is available. The header is sent by pressing the PRINT HEADER key from the MAIN SCREEN.

The status line of the configuration section will indicate that the header has been sent to the printer.

The following is the print header and sample data that are used for the Defibrillator Analyzer mode.

Gossen Metrawatt
SECULIFE DF$_{BASE}$ Defibrillator Analyzer

SECULIFE DF$_{BASE}$ Serial Number: _____
Dut Manufacturer: _____
Dut Model: _____
Dut Serial Number: _____
Technician: _____
Location: _____

Date: _____

PASS FAIL

Comments: _____
_____
_____

Test Data:

Test#	Ecg Wave	Ecg Amp	Defib Load	Dut Setting	SECULIFE DF$_{BASE}$ Measurements: Energy	Voltage	Current	Dely/ChgT
1	None	1.0 mV	50ohm	_____J	112.5J	1085.0V	21.7A	0mS

NOTE: Printing the header also resets the test number printed on the data sheet.

NOTE: In the test results, the user must manually write the power setting of the DUT.

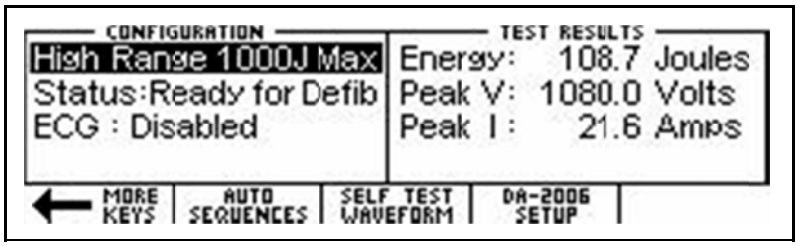
SELF TEST WAVEFORM

The SECULIFE DF$_{BASE}$ has built in test waveforms that will give an indication that the system is working

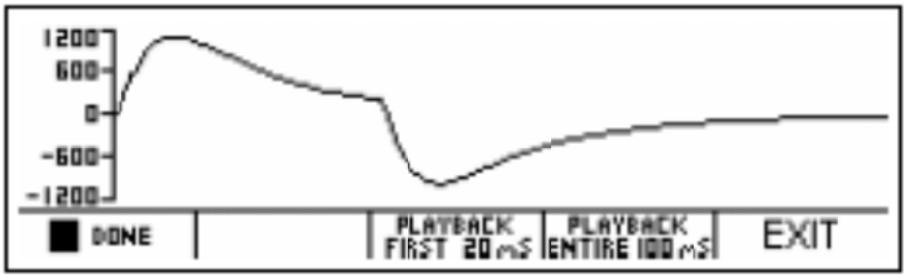
properly. The Self Test Waveform may be sent by pressing the SELF TEST WAVEFORM key from the MAIN SCREEN.

After the waveform has been sent, the results will be reflected in the test results section of the MAIN SCREEN and the PLAYBACK LAST PULSE SCREEN. The Self Test Waveform is not calibrated, but will provide a waveform that is approximately 125 Joules when configured for the High Range and 5 Joules when configured for the Low Range.

The following is an example of the MAIN SCREEN with the results of the Self Test Waveform:



The following is an example of the PLAYBACK LAST PULSE SCREEN, showing a graphical representation of the Self Test Waveform:



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RUNNING A DEFIBRILLATOR TEST

WARNING - CONNECTIONS

All connections to patients must be removed before connecting the Device Under Test (DUT) to the Analyzer. A serious hazard may occur if the patient is connected when testing with the Analyzer.
Do not connect any leads from the patient directly to the Analyzer or DUT.

INTRODUCTION

The SECULIFE DF_{BASE} will analyze the pulse output of a monophasic or biphasic defibrillator. The primary measure of the output is the Energy that it contains. Other information deals with the maximum voltage and current as well as the pulse timing with respect to the R-wave.

The human body has characteristic impedance that may vary, but 50 ohms is used for comparative defibrillator testing. The SECULIFE DF_{BASE} has a large internal 50 ohm non-inductive, high-power resistor to simulate a human body. It is sized to accept repeated pulses at the maximum energy levels.

The energy contained in a pulse is determined mathematically based on the fact that the energy is defined as the integral of the power curve. The following formulas describe the basic computation:

$$\text{Energy} = E = \int P \, dt$$

$$\text{Power} = P = V^2 / R \Rightarrow \int E = V^2 / R \, dt = \int V^2 \, dt / R$$

This computation is implemented digitally by taking timed samples of the voltage every 100 µsec for 100 msec (1000 readings). Each value is then squared and divided by the resistance (50 ohms). The sum of these 1000 values times 10 is then the Energy in Joules (Watt Seconds) contained in the pulse.

DEFIBRILLATION TEST

The setup for a Defibrillation Test is dependent on the physical hardware involved. For the sake of this example we will assume a standard defibrillator with 5 lead ECG.

WARNING

This section is provided as a guide to familiarize the user with the SECULIFE DF_{BASE}. It is not intended to provide the necessary test sequence for every Defibrillator. The user must consult the manufacturer's manual for each DUT to determine the correct test procedure to follow.

(1) Connect ECG leads to the corresponding universal connector on the SECULIFE DF_{BASE}. The connectors are marked with both the AHA and International color codes.

(2) Turn on the SECULIFE DF_{BASE}.

(3) The unit will come up in the "High Range Defibrillator" mode. This range is used for normal adult testing.

NOTE: If it is desirable to run a test at 50 Joules or less with a peak voltage of 1000 Volts or less, the unit may be changed to the "Low Range Defibrillator" mode using the 

key.

(4) Select "Ventricular Fibrillation" from the ECG WAVEFORM SCREEN with an amplitude of 1 mV. This is necessary for most automatic defibrillators.

(5) Place the Defibrillator Paddles on the SECULIFE DF_{BASE} contact plates. The APEX is on the right and the STERNUM is on the left.

NOTE: Reversing the paddles will not cause any damage to the unit or error in the energy reading. However, it will cause the polarity of the oscilloscope output and the playback waveform to be inverted.

(6) Holding the paddles firmly in place, charge the Defibrillator and discharge it into the SECULIFE DF_{BASE}.

WARNING

Observe all precautions noted by the Defibrillator Manufacturer when using the Defibrillator.

(7) The SECULIFE DF_{BASE} will automatically sense the voltage rise across the internal 50 ohm load and begin taking readings. After the sampling is done (100 ms) the unit will compute and display the results.

a. The power pulse is available at the oscilloscope output in real time at 200:1 signal attenuation when in low range and 1000:1 signal attenuation when in high range.

b. After the computation, the pulse is automatically played back at a 200:1 time base expansion (200 times slower) on both the ECG leads and the Paddle plates. The signal level is 1 mV per 1000 Volts on Lead 1.

c. At the same time, the test results are sent to the printer.

(8) The Status line will change to indicate the various steps as they are being done.

(9) At the end of the process the results are continuously displayed in the Test Results section of the MAIN SCREEN. They will remain there until another test is performed, the range is changed or the power is turned off.

(10) The user may repeat the playback of the waveform at any time by changing to the PLAYBACK LAST PULSE SCREEN using the 

key. In this screen the pulse may be viewed in 20 msec segments and paused for review.

NOTE: The pulse is sent to the ECG and Paddle outputs at the same time it is being displayed on the screen.

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CARDIOVERSION TEST

A Cardioversion Test is simply an energy test with special attention being given to the timing. The SECULIFE DF_{BASE} continuously monitors for the R-wave timing and displays, if possible, the delay between the R-wave and the pulse. In Cardioversion testing, the Defibrillator is set to deliver a pulse based on a specific delay after the R-wave.

WARNING

This section is provided as a guide to familiarize the user with the SECULIFE DF_{BASE}. It is not intended to provide the necessary test sequence for every Defibrillator. The user must consult the manufacturer's manual for each DUT to determine the correct test procedure to follow.

(1) Connect ECG leads to the corresponding universal connector on the SECULIFE DF_{BASE}. The connectors are marked with both the AHA and International color codes.

(2) Turn on the SECULIFE DF_{BASE}.

(3) The unit will come up in the "High Range Defibrillator" mode. This range is used for normal adult testing.

NOTE: If it is desirable to run a test at 50 Joules or less with a peak voltage of 1000 Volts or less, the unit may be changed to the "Low Range Defibrillator" mode using the 

key.

(4) Select the desired ECG Waveform and Amplitude to be tested from the choices on the ECG WAVEFORM SCREEN.

NOTE: The selected waveform must contain a QRS complex.

(5) Set the Defibrillator to Synchronized Cardioversion mode.

(6) Place the Defibrillator Paddles on the SECULIFE DF_{BASE} contact plates. The APEX is on the right and the STERNUM is on the left.

NOTE: Reversing the paddles will not cause any damage to the unit or error in the energy reading. However, it will cause the polarity of the oscilloscope output and the playback waveform to be inverted.

(7) Holding the paddles firmly in place, charge the Defibrillator and discharge it into the SECULIFE DF_{BASE}.

WARNING

Observe all precautions noted by the Defibrillator Manufacturer when using the Defibrillator.

(8) The SECULIFE DF_{BASE} will automatically sense the voltage rise across the internal 50 ohm load and begin taking readings. After the sampling is done (100 ms) the unit will compute and display the results.

a. The power pulse is available at the oscilloscope output in real time at 200:1 signal attenuation when in low range and 1000:1 signal attenuation when in high range.

b. After the computation, the pulse is automatically played back at a 200:1 time base expansion (200 times slower) on both the ECG leads and the Paddle plates. The signal level is 1 mV per 1000 Volts on Lead 1.

c. At the same time, the test results are sent to the printer.

(9) The Status line will change to indicate the various steps as they are being done.

(10) At the end of the process the results are continuously displayed in the Test Results section of the MAIN SCREEN. They will remain there until another test is performed, the range is changed or the power is turned off.

NOTE: Special note should be made of the “Delay: xxx msec” line in the results. This will show the delay between the peak of the R-wave and the start of the Pulse.

The user may repeat the playback of the waveform at any time by changing to the PLAYBACK LAST PULSE SCREEN using the 

key. In this screen the pulse may be viewed in 20 msec segments and paused for review.

NOTE: The pulse is sent to the ECG and Paddle outputs at the same time it is being displayed on the screen.

CHARGE TIME TEST

The charging time of a Defibrillator is nothing more than a measurement of the time required for the Defibrillator to charge. It is used to test the battery, charging circuitry and capacitor.

The SECULIFE DF_{BASE} provides a simple way to start and stop the timer. It also records the results.

WARNING

This section is provided as a guide to familiarize the user with the SECULIFE DF_{BASE}. It is not intended to provide the necessary test sequence for every Defibrillator. The user must consult the manufacturer's manual for each DUT to determine the correct test procedure to follow.

(1) Turn on the SECULIFE DF_{BASE}.

(2) The unit will come up in the "High Range Defibrillator" mode. This range is used for normal adult testing.

(3) Set the Defibrillator to its maximum power setting.

(4) Depress the 

key.

(5) While the Pre-Warning Countdown is running, place the Defibrillator Paddles on the SECULIFE DF_{BASE} contact plates. The APEX is on the right and the STERNUM is on the left.

NOTE: Reversing the paddles will not cause any mage to the unit or error in the energy reading. However, it will cause the polarity of the oscilloscope output and the playback waveform to be inverted.

(6) Holding the paddles firmly in place, wait until the Pre-Warning Countdown equals zero and then immediately start charging the Defibrillator.

(7) As soon as the DUT is fully charged, discharge it into the SECULIFE DF_{BASE}.

WARNING

Observe all precautions noted by the Defibrillator Manufacturer when using the Defibrillator.

(8) At the end of the process the results are continuously displayed in the Test Results section of the MAIN SCREEN. They will remain there until another test is performed, the range is changed or the power is turned off.

NOTE: The last line in the Test Results section of the screen will show "Chg Time: xxx.x sec"

SHOCK ADVISORY ALGORITHM TEST

The Shock Advisory Algorithm Test works with the analysis and prompting functions on automatic and semiautomatic Defibrillators. These circuits look at ECG waveforms and prompt the user to “Shock” or “No Shock” based on national and international guidelines. The following table outlines these guidelines:

SHOCK ADVISORY ALGORITHM TEST	
ECG SIGNALS	**ACTION**
Asystole	No Shock
Supra Ventricular Tachycardia @ 90 BPM	No Shock
Polyfocal Ventricular Tachycardia @ 140 BPM	No Shock
Multifocal Ventricular Tachycardia @ 140 BPM	No Shock
Coarse Ventricular Fibrillation	Shock
Fine Ventricular Fibrillation	Shock
Polyfocal Ventricular Tachycardia @ 160 BPM	Shock
Multifocal Ventricular Tachycardia @ 160 BPM	Shock

WARNING

This section is provided as a guide to familiarize the user with the SECULIFE DF_{BASE}. It is not intended to provide the necessary test sequence for every Defibrillator. The user must consult the manufacturer’s manual for each DUT to determine the correct test procedure to follow.

(1) Connect ECG leads to the corresponding universal connector on the SECULIFE DF_{BASE}. The connectors are marked with both the AHA and International color codes.

(2) Turn on the SECULIFE DF_{BASE}.

(3) The unit will come up in the “High Range Defibrillator” mode. This range is used for normal adult testing.

(4) Select the desired AED Waveform and Amplitude to be tested from the choices on the ECG WAVEFORM SCREEN.

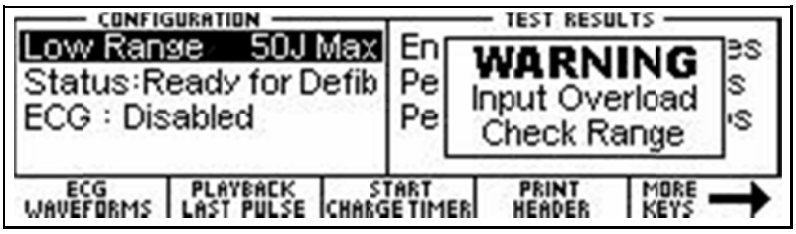
(5) Set the Defibrillator to analyze the ECG waveform in the automatic or semiautomatic mode.

(6) Observe and record the response of the Defibrillator to the various waveforms.

MESSAGES

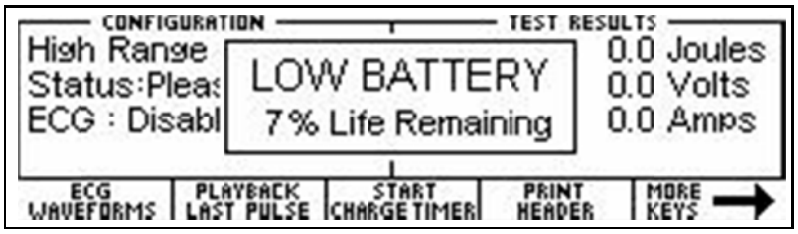
INPUT OVERLOAD

The “Warning Input Overload Check Range” message can display during Defibrillator testing. The range should be checked to see if it should be changed to High Range for the current Joule setting.



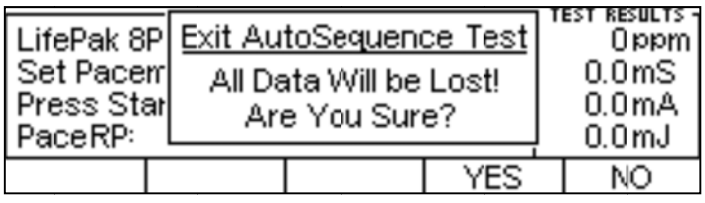
LOW BATTERY

This message indicates that the batteries are low and should be replaced.



EXITING AUTO SEQUENCE TESTING

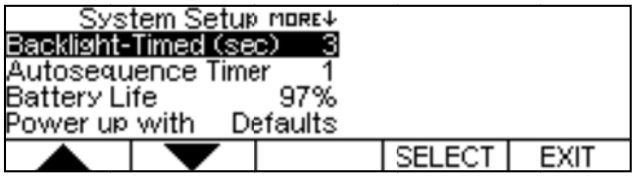
The “Exit Auto Sequence Test All Data Will be Lost!” message will display in the Auto Sequencing Mode when EXIT is pushed. If the data is needed, it should be printed prior to exiting.



SYSTEM SETUP

The SYSTEM SETUP SCREEN allows for the configuration of the system settings. The settings can be Selected using ▲▼ to highlight the parameter and using SELECT to allow the editing of the parameter. The ▲▼ keys are used to edit the setting, then ENTER is used to accept the new setting. The CANCEL key can be used to return to the configuration screen without making a new selection.

The EXIT key is to return to the MAIN SCREEN.



The following is a brief description of the parameters and the available range of settings:

Parameter	Description	Range
Backlight Timed	Off – Always off 1-20 sec – The elapsed time after which the backlight will automatically turn off. Always On – The backlight will be manually controlled by backlight key)	Off, 1-20 sec, Always On
Auto Sequence Timer	Sets the delay between Auto Sequence tests when the test passes.	1-20 sec
Battery Life	Displays current life of the batteries. At 5%, a warning screen will appear. At 10%, the unit will power down automatically.	5-100% (Read Only)
Power up with	Selects the values that will be used when the unit is first turned on. It is also used to Set the Custom Defaults, if used. (See Power Up Settings).	Default/Last/ Custom/ Set Custom Defaults
Software	Displays current software program.	(Read Only)

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POWER UP SETTINGS

The SECULIFE DF$_{BASE}$ allows the user to tailor the settings that the unit will have on Power Up. The "Power Up With" parameter in the System Setup Menu allows for the selection of either Default or Custom selections.

DEFAULT

If this option is selected the following settings will be used every time the unit is turned on. Range – Defib, High Range mode

ECG – Output Disabled

CUSTOM

If this option is selected, the user may save a unique set of default parameters and the unit will recall them every time the power is turned on.

SET CURRENT AS CUSTOM

The user simply configures the unit to the desired default conditions, selects this option and presses ENTER. The current configuration is then saved as the Custom Power up values.

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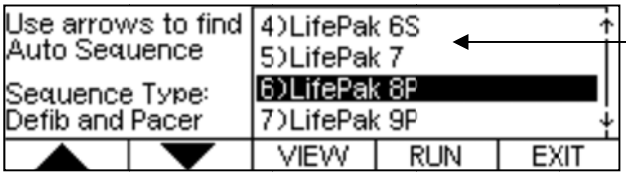
AUTO SEQUENCE FUNCTION

The SECULIFE DF_{BASE} allows the user run up to 50 pre-programmed sequences of tests (Auto Sequences). The tests are configured with an easy to use PC program. Each test can be configured to test Defibrillator, Transcutaneous Pacemaker or both. (For programming Auto Sequences, see the Auto Sequence Programming section).

Once configured, the tests are then downloaded to the SECULIFE DF_{BASE} unit through the RS232 serial interface.

The AUTO SEQUENCE SCREEN is accessed using the AUTO SEQUENCES key.



AUTO SEQUENCES

- LifePak 4
- LifePak 5
- LifePak 6
- LifePak 6S
- LifePak 8P
- LifePak 9P
- LifePak 9PM
- LifePak 10
- LifePak 10P
- LifePak 10PM
- HP 78660A
- HP XLPM
- Nihon Kohden 7000
- Laerdal HS 2000
- Marquette 1500PM
- Zoll PD 2000
- Zoll M-Series DSW
- Zoll AED Plus
- Blank Tests 20-50

In this menu, the ▲ ▼ key are used to select the desired test.

The VIEW key can be used to enter the VIEW MODE which will allow the user to view the programmed test options of the selected test. The RUN key will run the test and enter the RUN MODE which will step the technician through the programmed test as well as identify whether each step has passed or failed based upon the pre-programmed test limits that are part of each Auto Sequence.

The following table shows the possible test sequence with the details and options that can be selected using the PC program:

Test	Description	Fields	Options
	Defibrillator	**Test Sequence**	
Defib Energy Tests	Measures defibrillator discharge energy	Steps	1-20 xxx Joules
		Energy Level Limits	0-99%
		VFIB ECG Output	yes/no
Maximum Energy Test	Measures time required for defibrillator to charge to maximum energy	Do Test?	yes/no
		Energy Level Limits	xxx Joules
		Max Allowed Charge Time	x sec
Cardioversion Tests	Measures Cardioversion Delay	Steps	1-3 xxx Joules
		Energy Level Limits	0-99%
ECG Performance Test	Tests defibrillator ECG input	Steps	Up to 10
		Waveform Outputs and Amplitudes	x Waveform Group x Waveform Lead II = x.x mV

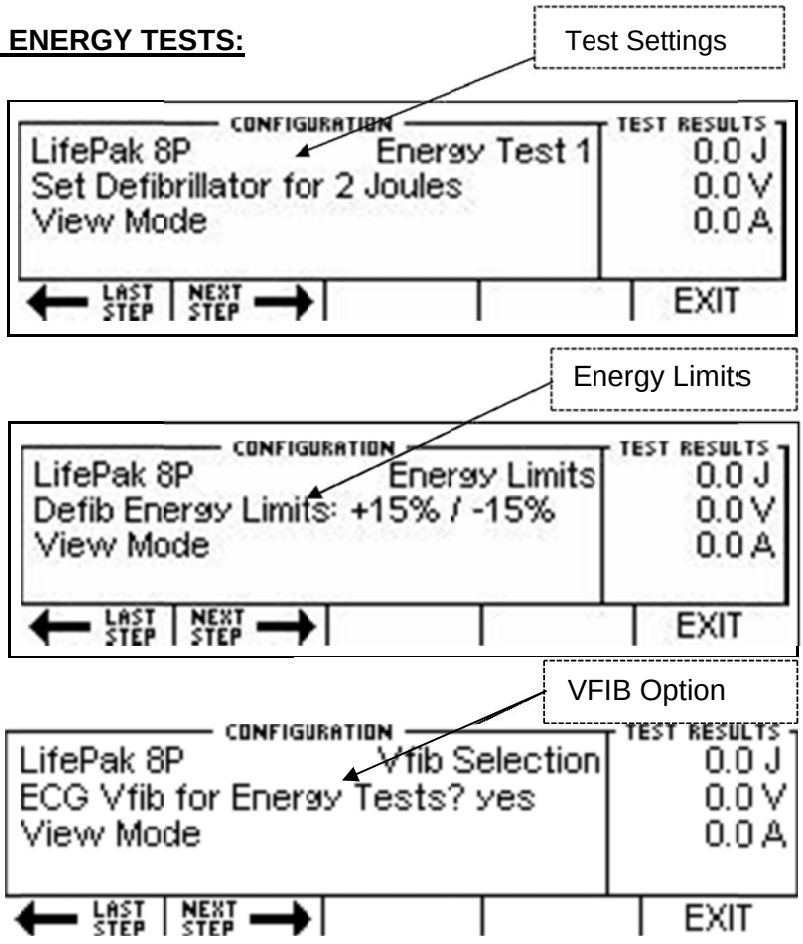
VIEW MODE

The VIEW MODE allows the user to look at the test configuration. Each test setting will be shown, as well as the test limits that identify a valid or invalid test result. The screens that are displayed in the VIEW MODE are determined by the Auto Sequence selected on the AUTO SEQUENCE SCREEN and its configuration as defined with the PC program.

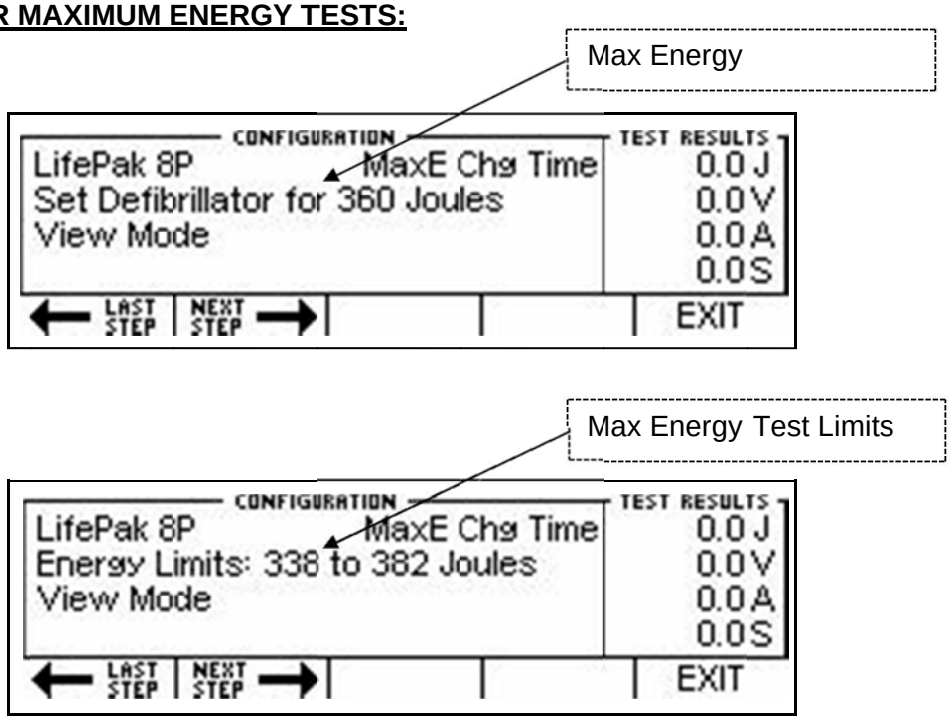
The following screens are examples of what could be shown in the VIEW MODE if all test options are selected:

NOTE: If any particular test option is disabled using the PC Program, it will not be shown in the VIEW MODE.

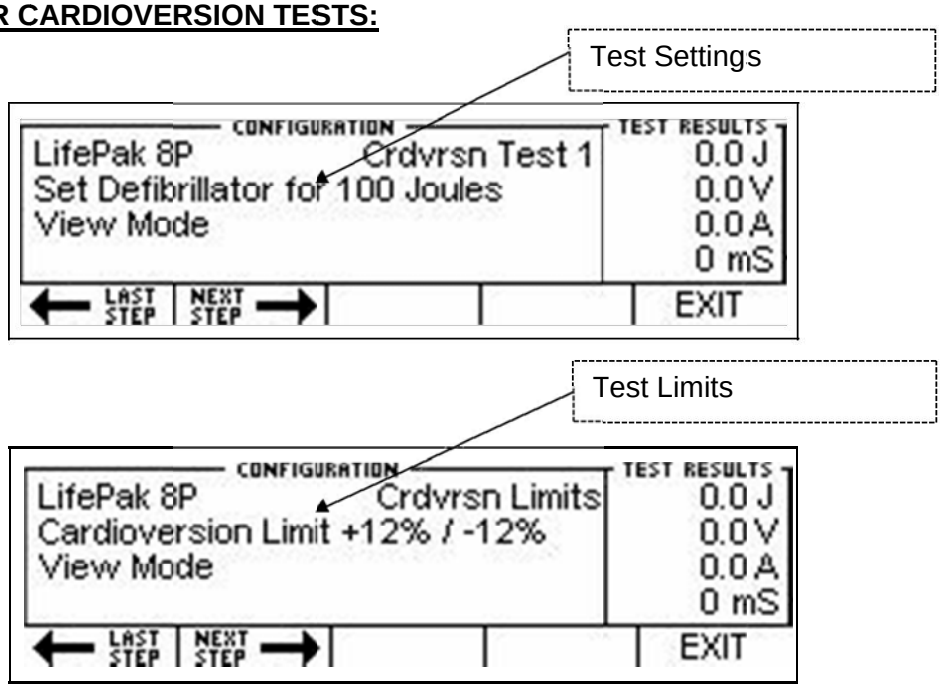
DEFIBRILLATOR ENERGY TESTS:



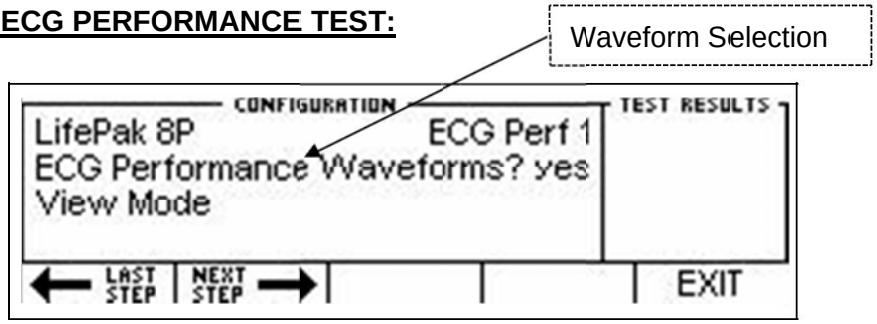
DEFIBRILLATOR MAXIMUM ENERGY TESTS:



DEFIBRILLATOR CARDIOVERSION TESTS:



DEFIBRILLATOR ECG PERFORMANCE TEST:



NOTE: The individual selected waveforms are not displayed in the VIEW MODE.

RUN MODE

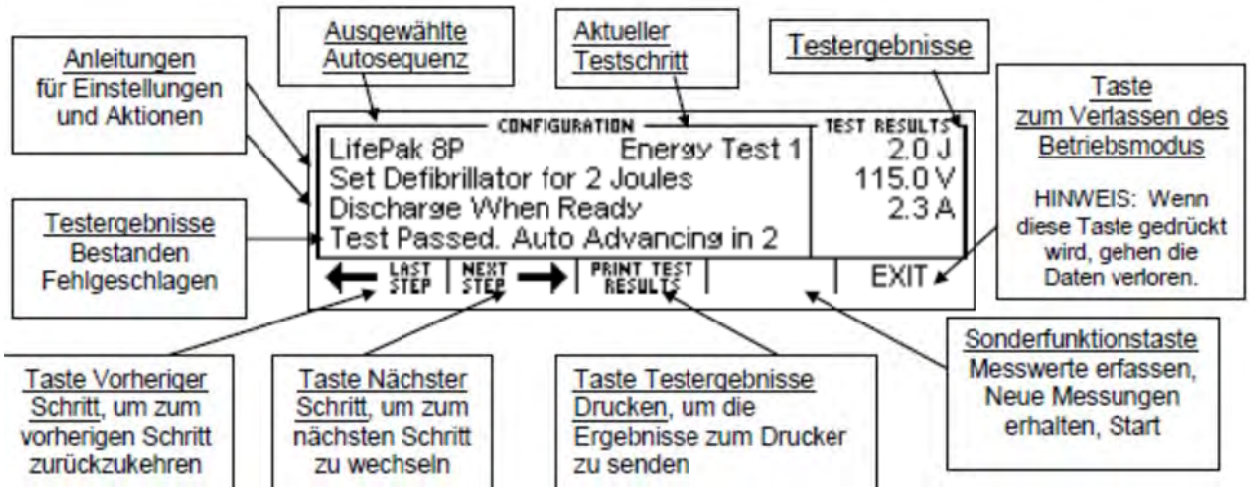
The RUN MODE allows the user to run the test configuration. The screens that are displayed in the RUN MODE are determined by the Auto Sequence selected on the AUTO SEQUENCE SCREEN and its configuration as defined with the PC program.

Running an Auto Sequence will provide a consistent, guided procedure for testing equipment. This is a semi-automated process that will provide immediate feedback to the user if the DUT passes or fails individual tests. A programmable timer is provided to automatically progress through the test when a given test passes. This timer is set in the Auto Sequence Timer parameter in the SYSTEM SETUP SCREEN.

NOTE: If any particular test option is disabled using the PC Program, it will not be shown in the RUN MODE.

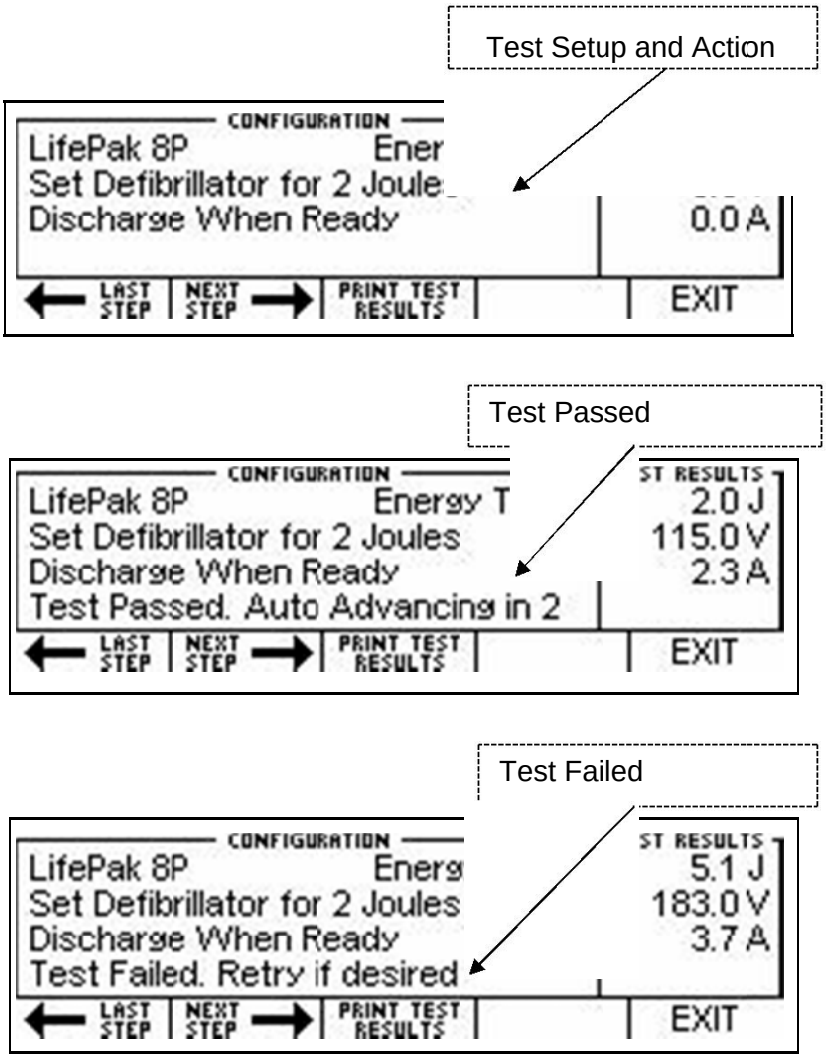
NOTE: Some tests, like Performance Waveforms, do not have quantitative analyses and therefore require the user to manually progress through the test.

The following sample screen shows the common elements present during the RUN MODE:

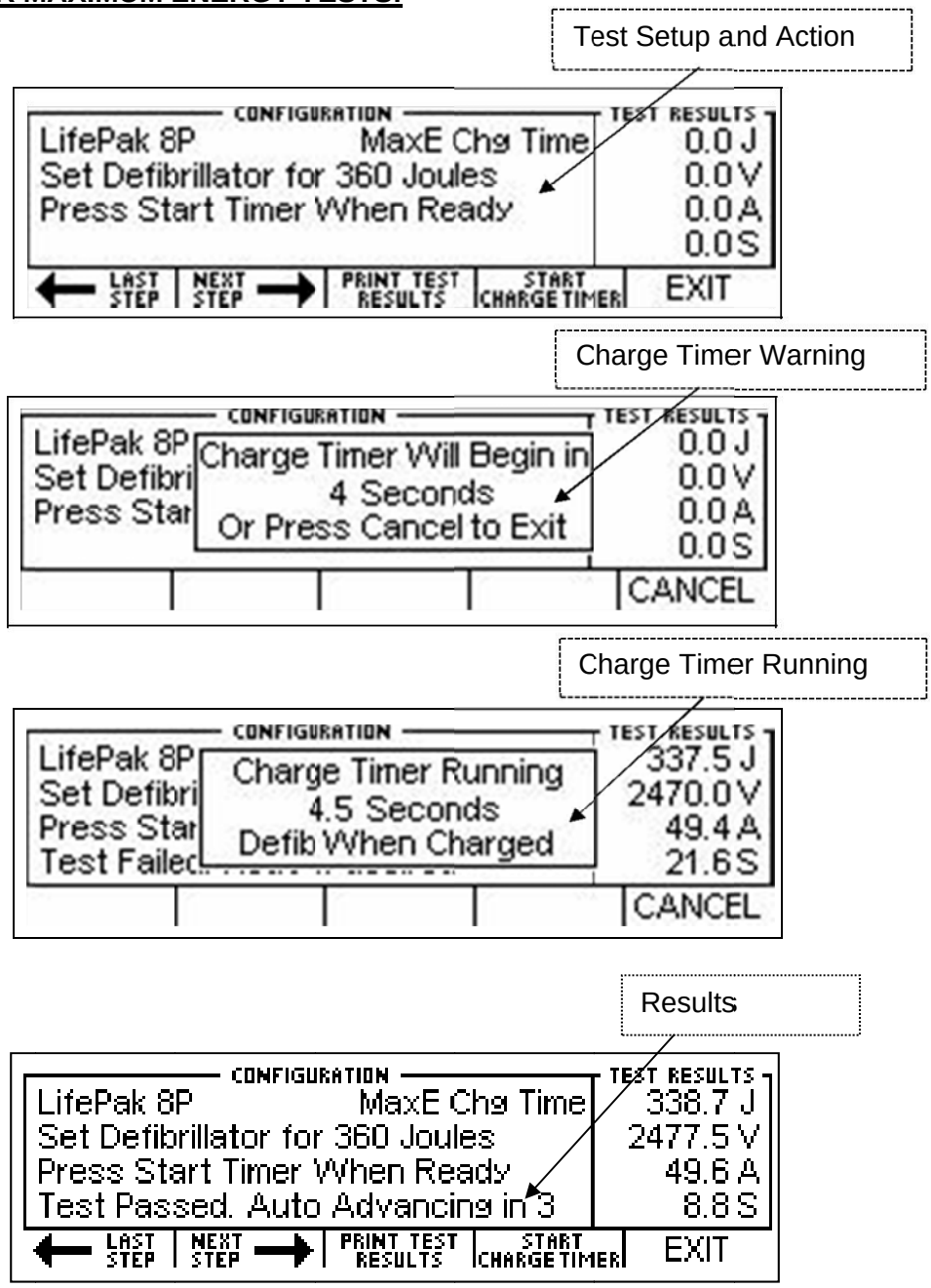


The following screens may be shown in the RUN MODE if all test options are selected:

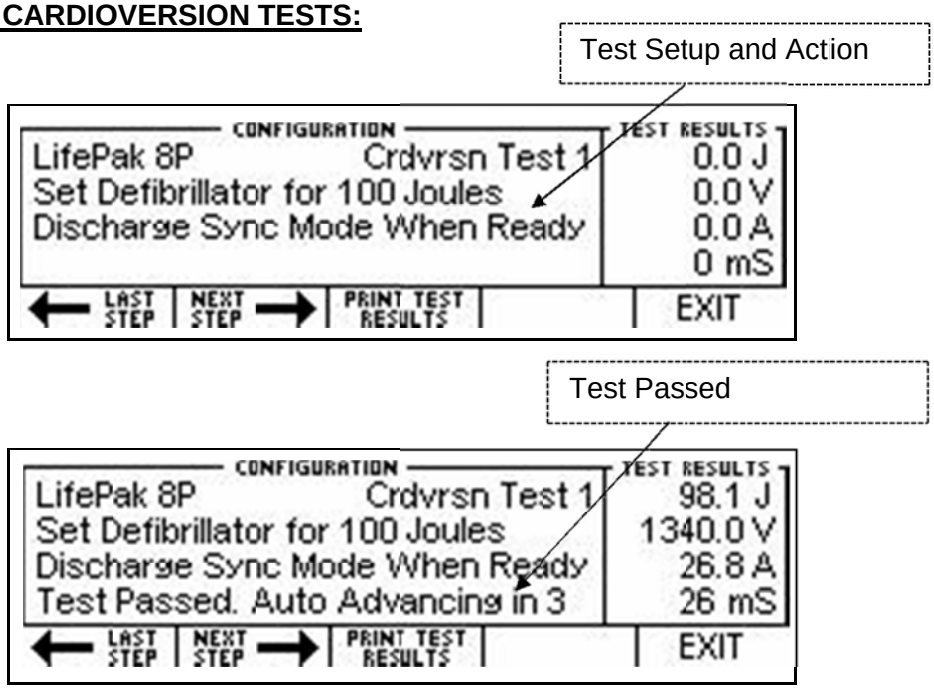
DEFIBRILLATOR ENERGY TESTS



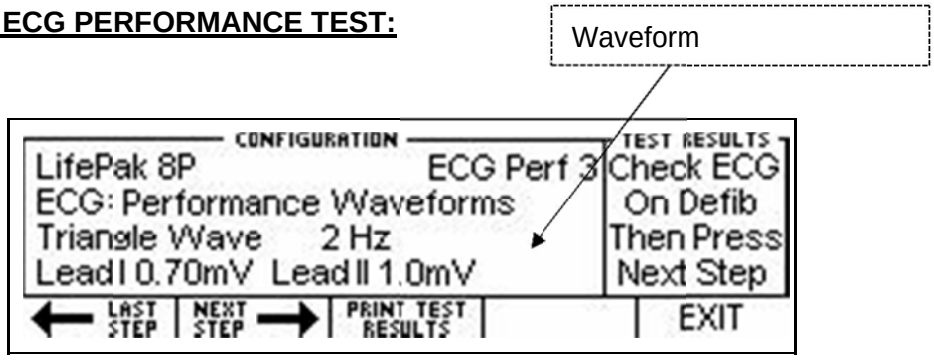
DEFIBRILLATOR MAXIMUM ENERGY TESTS:



DEFIBRILLATOR CARDIOVERSION TESTS:



DEFIBRILLATOR ECG PERFORMANCE TEST:



NOTE: Some tests, like Performance Waveforms, do not have quantitative analyses and therefore require the user to manually progress through the test.

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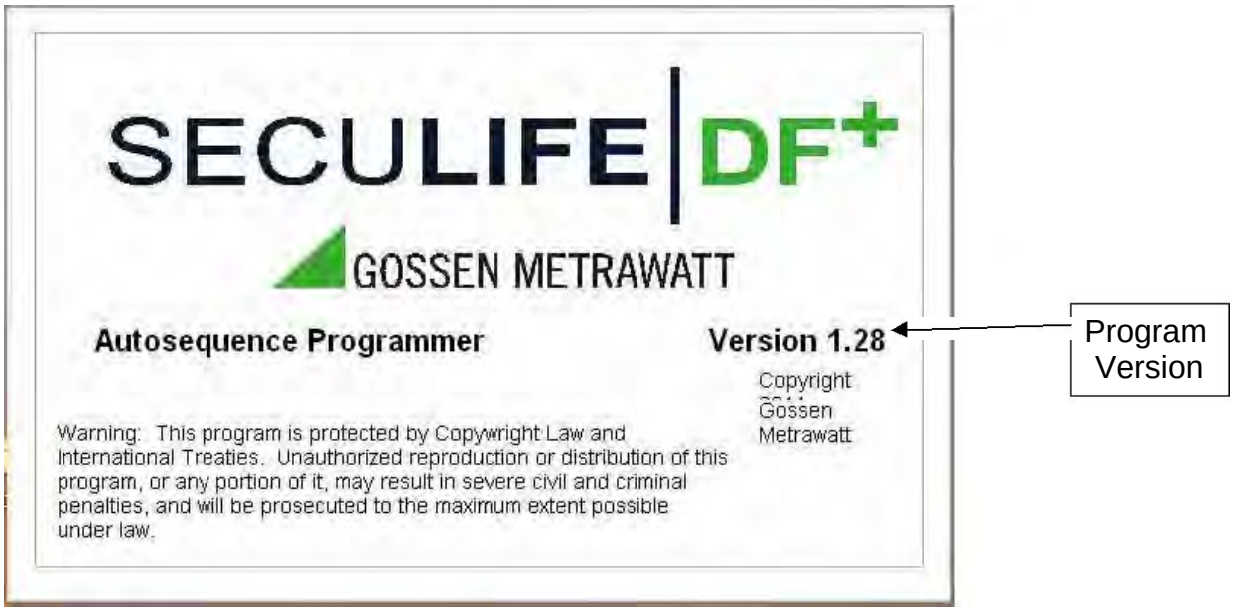
PROGRAMMING AUTO SEQUENCES

Auto Sequences are programmed with an easy to use PC interface. This section shows how to use the Auto Sequence configuration software.

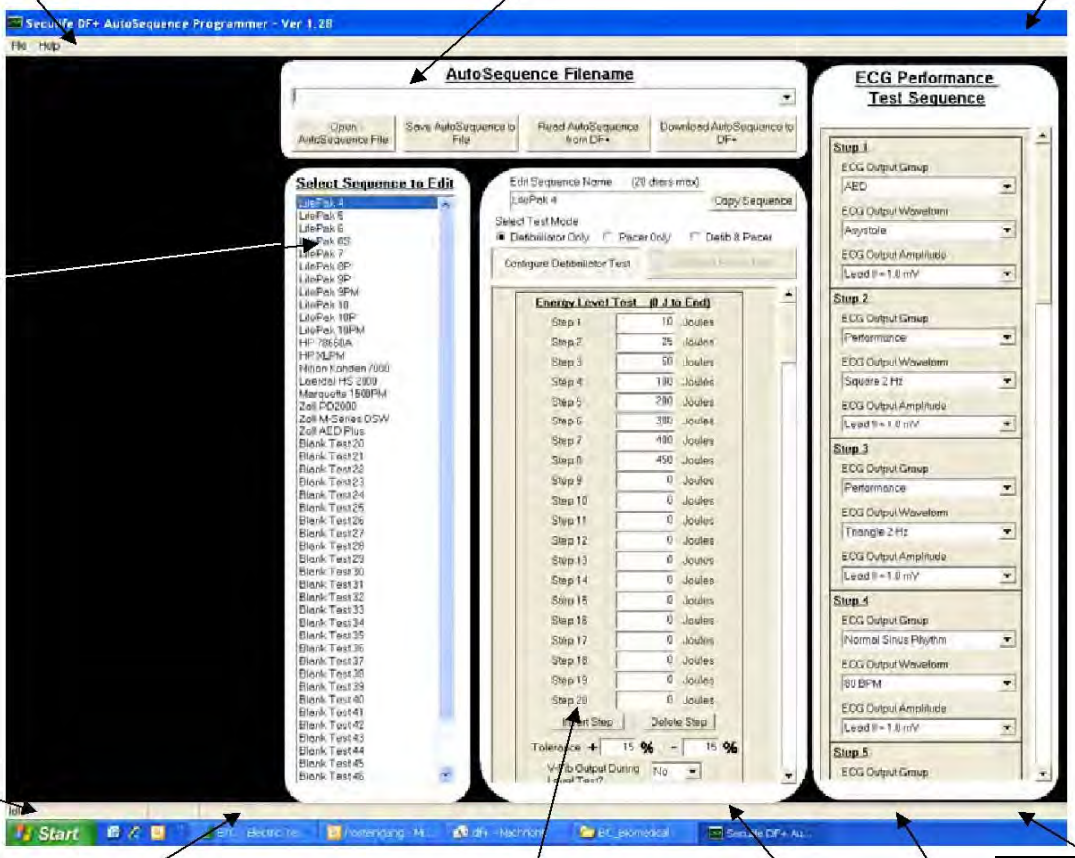
SPLASH SCREEN

The Splash Screen identifies the version of the program. This screen will be displayed for 5 seconds, or until the user presses a key or clicks the screen with the mouse.



OVERVIEW

The following is a general overview of the PC Interface used for Programming Auto Sequences. Each part of this screen is described in full detail later in this section.



Program Menu Bar

File Control
This section is utilized to load/save configuration files on the PC as well as read/write the auto configuration in the SECULIFE DF$_{BASE}$

ECG Sequence Programming
Use this section to easily configure each step of the ECG Auto Sequence

Sequence Selection
Use this list to select which sequence to view /edit.

Status Message

Com Port being used

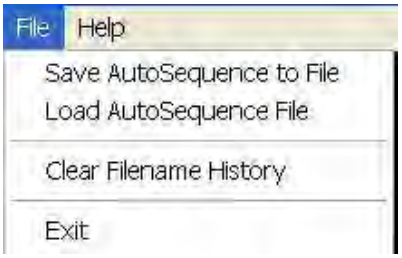
Sequence Configuration
Use this section to configure each Auto Sequence test.

Task Progress Indicator

Today's Date

Current Time

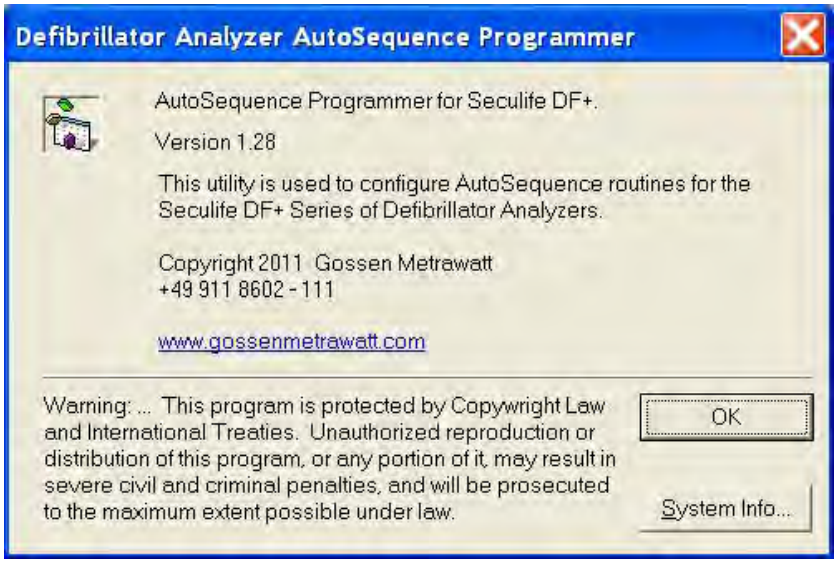
PROGRAM MENU



The program menu contains shortcuts to file operations as well as program version information.

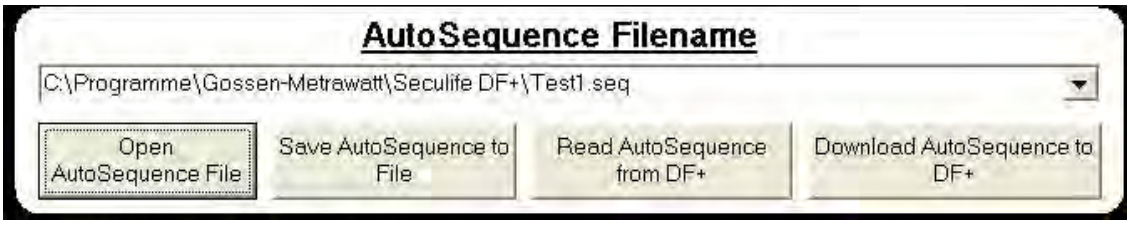
From the File Menu, you can Save or Load Auto Sequences as well as Clear the History of files that were used. You can also Exit the program from this menu.

The Help Menu provides access to program version information, shown below:



FILE CONTROL

The file control section allows the user to Load and Save Auto Sequence files, greatly expanding the number of pre-programmed sequences from 50 to virtually unlimited. The user also uses the File Control section to Load and Store Auto Sequences on the SECULIFE DF_{BASE}.



Dropdown List – This list shows the history of files that have recently been used. This provides quick access for switching between common Auto Sequence files.

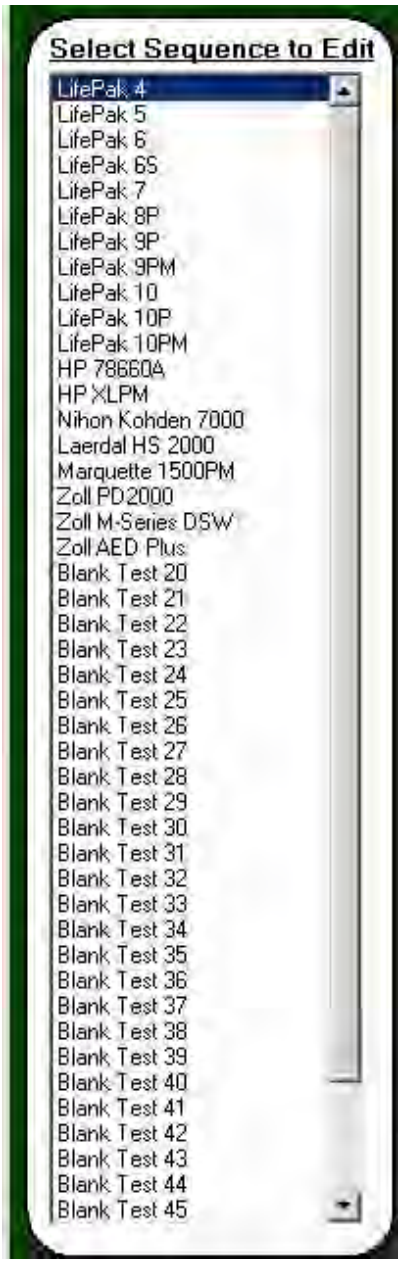
Open Auto Sequence File – This button brings up the standard Windows Open File dialog box. It is used to load an existing configuration file.

Save Auto Sequence to File – This button brings up the standard Windows Save File dialog box. It is used to save the current configuration to a file for future reference.

Read Auto Sequence from SECULIFE DF_{BASE} – This button is used to load the configuration currently stored in the SECULIFE DF_{BASE}.

Download Auto Sequence to SECULIFE DF_{BASE} – This button is used to send the configured Auto Sequence to the SECULIFE DF_{BASE}, where it is stored in non-volatile flash memory.

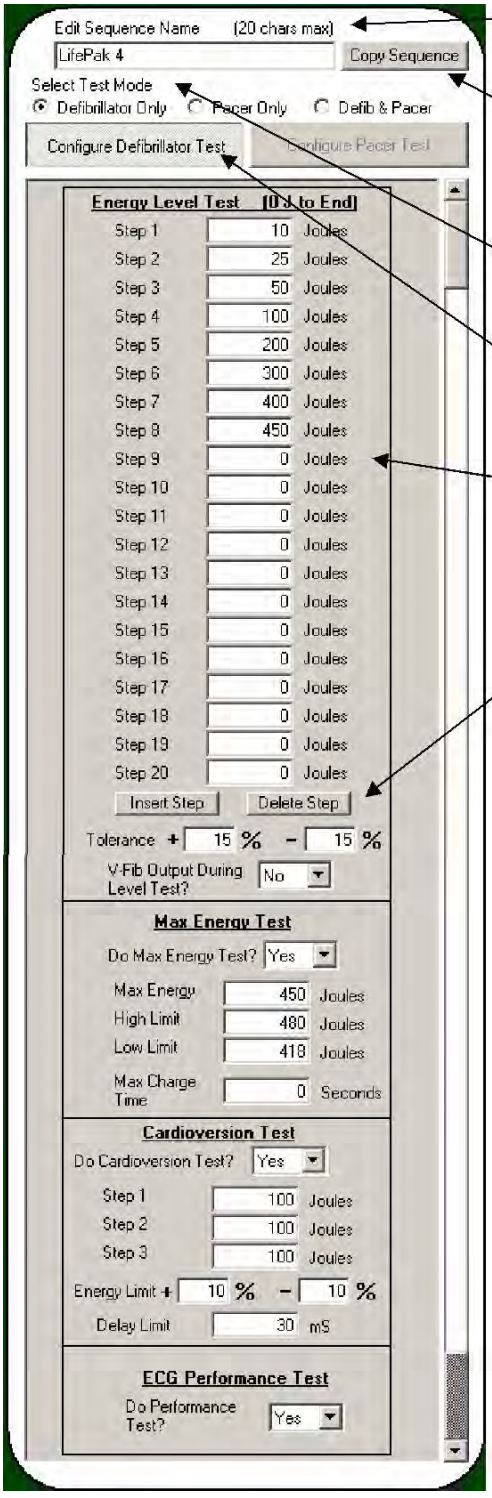
SEQUENCE SELECTION



This section shows a list of all of the names of the Auto Sequences. It is used to select an individual sequence for configuration. Once selected, the configuration window will change to display the settings for the selected sequence.

SEQUENCE CONFIGURATION

The sequence configuration window displays all of the configuration settings for each Auto Sequence. This sample screen shows a defib test configuration.



Sequence Name – This name can be any string of up to 20 standard ASCII characters. NOTE: Not all ASCII characters are valid and will be ignored.

Copy Sequence Button – This button opens the Copy Sequence Screen that allows the user to quickly configure similar test sequences.

Test Mode Selections – These selections allow each test to be configured as a Defibrillator Only, a Pacer Only or a Defib & Pacer test.

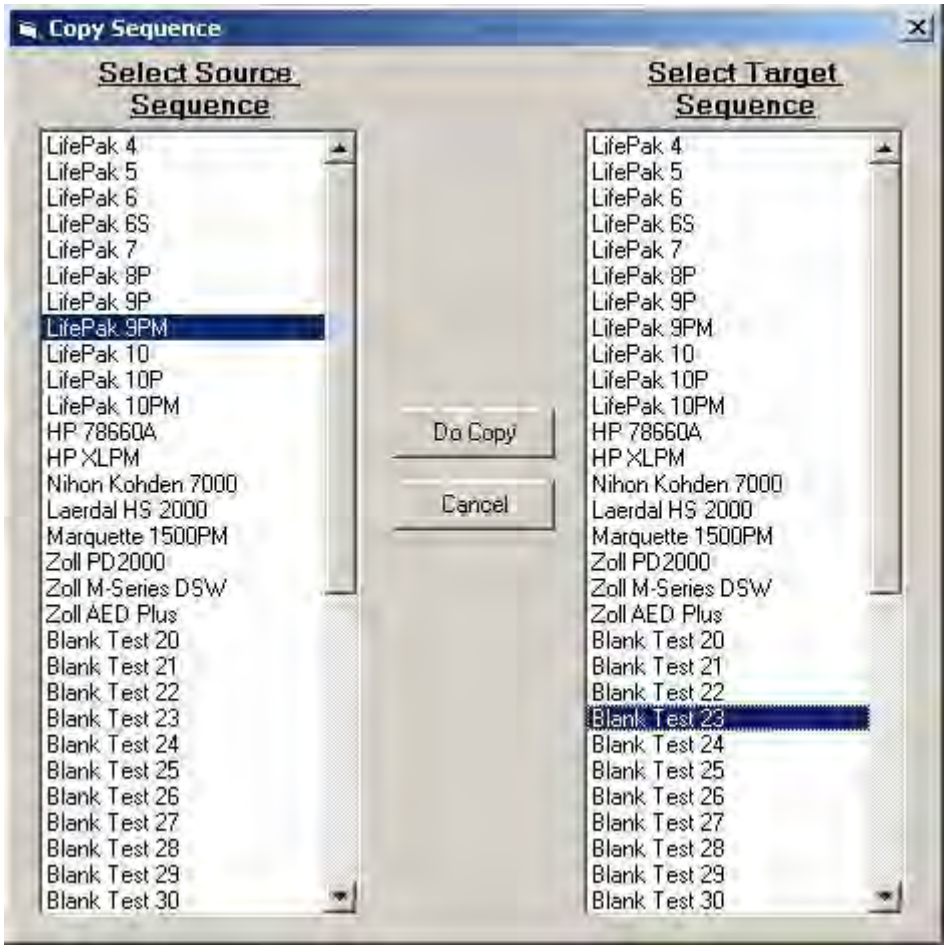
Configure Test Buttons – These buttons are used to alternate between defib and pacer test configuration windows.

Defibrillator Test Details – Each of the potential tests and test details for the Defibrillator are displayed for configuration. For ease of programming, individual steps can be deleted or added and individual tests can be included or not included.

Insert and Delete Steps Buttons – These buttons will open the Insert Steps Screen or the Delete Steps Screen.

Copy Sequence Screen

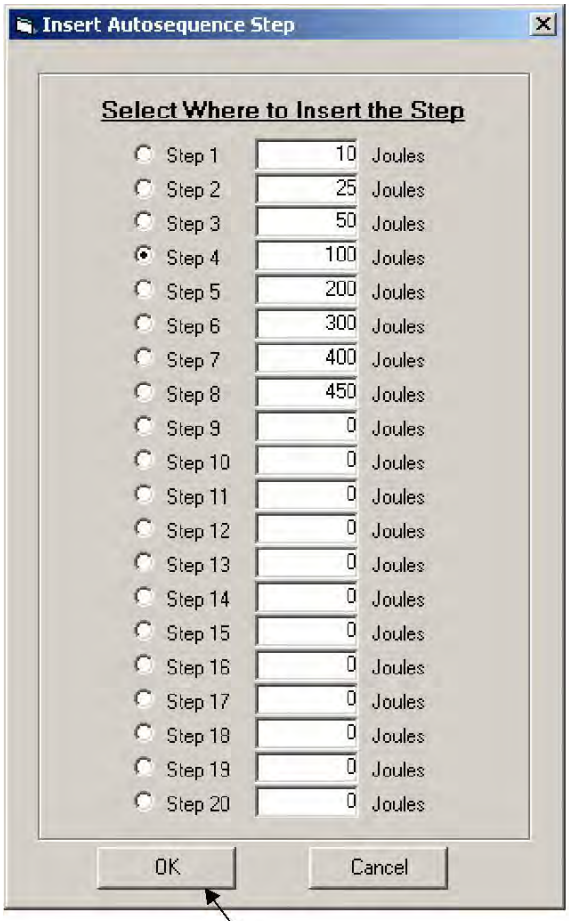
This function allows the user to quickly configure similar Auto Sequences. Simply select the source and target test sequences, press OK, and the target sequence will be overwritten with the configuration from the source sequence configuration. The Cancel button will exit the window without modifying any configuration settings.



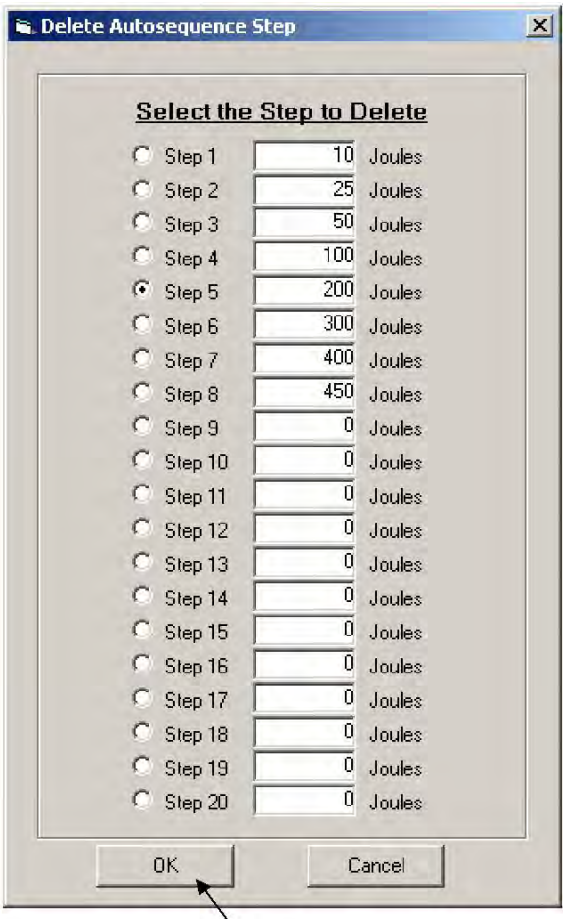
Insert Step and Deleting Step Screens

The insert and delete functions allow the user to quickly modify an existing test configuration. Deleting a step will move all of the tests following the deleted test up by one step and clear the final step. Inserting a step will shift all following steps down by one step and clear the selected step location.

Defibrillator Examples:

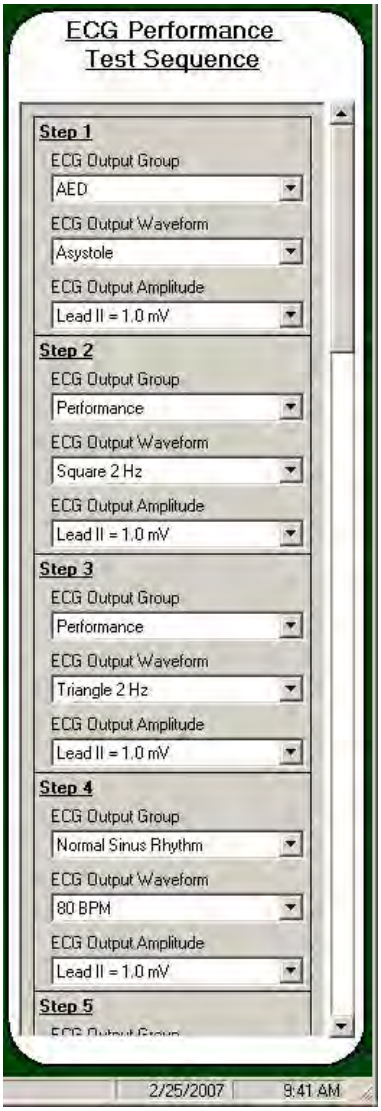


Pressing OK here would shift steps 4-19 down by one step and insert a blank step at step 4.



Pressing OK here would shift steps 6- 20 up by one step and insert a blank step at step 20.

ECG CONFIGURATION SECTION



This section configures the ECG Performance sequence when the ECG Performance Test option is set to YES for a Defibrillator Test.

The ECG sequence consists of up to 10 steps. Each step consists of a selected waveform group (Disabled, NSR, AED, Arrhythmia or Performance), output waveform and output amplitude.

There is only one ECG sequence for all 50 Auto Sequence tests.

To use less than 10 steps, set the ECG output group of the next step after the last to “Disabled.”

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LIMITED WARRANTY

WARRANTY: GMC-I MESSTECHNIK GMBH WARRANTS ITS NEW PRODUCTS TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP UNDER THE SERVICE FOR WHICH THEY ARE INTENDED. THIS WARRANTY IS EFFECTIVE FOR TWELVE MONTHS FROM THE DATE OF SHIPMENT.

EXCLUSIONS: THIS WARRANTY IS **IN LIEU OF** ANY OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF **MERCHANTABILITY** OR FITNESS FOR A PARTICULAR PURPOSE.

GMC-I MESSTECHNIK GMBH IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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REMEDIES: THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY SHALL BE: (1) THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR PRODUCTS, WITHOUT CHARGE. (2) AT THE OPTION OF **GMC-I MESSTECHNIK GMBH**, THE REFUND OF THE PURCHASE PRICE.

SPECIFICATIONS

ENERGY OUTPUT MEASUREMENT GENERAL	
METHOD	Monophasic or Biphasic
LOAD RESISTANCE	50 ohm +/- 1%, non-inductive (<1 µH)
DISPLAY RESOLUTION	0.1 Joules
MEASUREMENT TIME WINDOW	100 ms
ABSOLUTE MAX PEAK VOLTAGE	6000 Volts
PULSE WIDTH	100 ms
CARDIOVERSION	
DELAY	0 to 6000 ms
RESOLUTION	0.1 ms
ACCURACY	+/-2 ms

ENERGY OUTPUT MEASUREMENT HIGH RANGE	
VOLTAGE	≤5000 Volts
MAX CURRENT	100 Amps
MAX ENERGY	1000 Joules
ACCURACY	+/-2% of reading for >100 Joules +/-2 Joules for <100 Joules
TRIGGER LEVEL	100 Volts
PLAYBACK AMPLITUDE	1 mv / 1000 V Lead 1
TEST PULSE	125 Joules +/- 20%

ENERGY OUTPUT MEASUREMENT LOW RANGE	
VOLTAGE	<1000 Volts
MAX CURRENT	20 Amps
MAX ENERGY	50 Joules
ACCURACY	+/-2% of reading for >20 Joules +/- 0.4 Joules for <20 Joules
TRIGGER LEVEL	20 Volts
PLAYBACK AMPLITUDE	1 mV / 1000 V Lead 1
TEST PULSE	5 Joules +/-20%

ENERGY OUTPUT MEASUREMENT OTHER	
OSCILLOSCOPE OUTPUT	
HIGH MEASURE RANGE	1000:1 amplitude-attenuated
LOW MEASURE RANGE	200:1 amplitude-attenuated
WAVEFORM PLAYBACK	
OUTPUT	LEAD I & PLATES
SCREEN	200:1 Time Base Expansion
SYNC TIME MEASUREMENTS	
TIMING WINDOW	Starts at peak of each R-wave
TEST WAVEFORMS	All waveform simulations available
DELAY TIME ACCURACY	+/- 1 ms
CHARGE TIME MEASUREMENT	
From 0.1 to 99.9 sec	

	ECG NSR
RATE	30,40,45,60,80,90,100,120,140,160, 180,200,220,240,260,280,300 BPM
ACCURACY	+/- 1%
AMPLITUDE	0.5,1.0,1.5,2.0 mV (Lead II)
ACCURACY	+/- 2% @ Lead II
HIGH LEVEL	200 times Amplitude
ACCURACY	+/- 5%
QRS DURATION	80ms

ECG PERFORMANCE	
SINE WAVE	0.1,0.2,0.5,5,10,40,50,60,100 Hz
SQUARE WAVE	0.125, 2.000 Hz
TRIANGLE WAVE	2.000, 2.500 Hz
PULSE WAVE	30,60,120 BPM; 60 ms width
AMPLITUDE	0.5,1.0,1.5,2.0 mV (Lead II)
RATE ACCURACY	+/- 1%
AMPLITUDE ACCURACY	+/- 2% @ Lead II

	ECG GENERAL
LEAD TO LEAD IMPEDANCE (RL, LL, RA, LA)	1000 ohm
LEAD TO LEAD IMPEDANCE (V1-V6)	1000 ohm

ECG ARRHYTHMIA SELECTIONS
Ventricular Fibrillation
Atrial Fibrillation
Second Degree A-V Block
Right Bundle Branch Block
Premature Atrial Contraction
PVC Early
PVC Standard
PVC R on T
Multifocal PVC
Bigeminy
Run of 5 PVCs
Ventricular Tachycardia

SHOCK ADVISORY ALGORITHM TEST ECG SIGNALS
Asystole
Coarse Ventricular Fibrillation
Fine Ventricular Fibrillation
Multifocal Ventricular Tachycardia @ 140 BPM
Multifocal Ventricular Tachycardia @ 160 BPM
Polyfocal Ventricular Tachycardia @ 140 BPM
Polyfocal Ventricular Tachycardia @ 160 BPM
SupraVentricular Tachycardia @ 90 BPM

DATA INPUT/OUTPUTS
Parallel Printer Port
RS-232C (for computer control)

PHYSICAL	
DISPLAY	LCD Graphical 240 X 64 Pixels, Backlit
ENCLOSURE	3.4 x 9.8 x 10.7 Inches (86.4 x 249 x 271.8 mm) Royalite R59 UL Flame Rating 94 V-0
WEIGHT	< 5 Lbs (< 2.3 Kg)
FACE PLATE	Lexan, Back printed
OPERATING RANGE	15 to 40 C
STORAGE RANGE	-20 to 65 C

ELECTRICAL	
POWER	Battery, 9 VDC (2 required)  Alkaline
BATTERY ELIMINATOR	20 - 21103 (120 VAC) (US Version) 20 - 21101 (220 VAC) (Euro Version) 10V, 300 mA DC

Product Support

If required please contact:

GMC-I Messtechnik GmbH
Product Support Hotline
Phone +49 911 8602-0
Fax +49 911 8602-709
E-Mail support@gossenmetrawatt.com

Service Center

Repair and Replacement Parts
Service Calibration Center *
and Rental Instrument Service
If required please contact:

GMC-I Service GmbH
Service Center
Thomas-Mann-Strasse 20
90471 Nürnberg • Germany
Phone +49 911 817718-0
Fax +49 911 817718-253
E-Mail service@gossenmetrawatt.com
www.gmci-service.com

This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

* DAkkS Calibration Laboratory
for Electrical Quantities D–K–15080-01-01 accredited
per DIN EN ISO/IEC 17025:2005
Accredited measured quantities: direct voltage, direct current -values, DC -resistance, - alternating voltage, -alternating current -values, AC active power, AC apparent power, DC power, -capacitance, -frequency and temperature

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