



WHALETEQ

HECG100

User Manual



Firmware Version 1.0.21 Revision 2025-03-06



Copyright © 2013-2025, All Rights Reserved. WhaleTeq Co. LTD

No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form, or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior written permission of WhaleTeq Co. LTD.

<u>Disclaimer</u>

WhaleTeq Co. LTD. provides this document and the programs "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose.

This document could contain technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in future revisions of this document. WhaleTeq Co. LTD. is under no obligation to notify any person of the changes.

The following trademarks are used in this document:

WHALETER is a registered trademark of WhaleTeq Co. LTD

All other trademarks or trade names are property of their respective holders.



Contents

1	Introduction	7
	1.1 Overview	7
	1.2 Hardware Overview	8
	1.3 Specifications	9
2	Installation and Settings	14
	2.1 Installation	14
	2.2 Home Screen	15
	2.3 "Waveform" Function	16
	2.3.1 "Wave" Parameter	16
	2.3.2 "Frequency" Parameter	17
	2.3.3 "Amplitude" Parameter	17
	2.3.4 "DC offset" Parameter	18
	2.3.5 "Noise" Parameter	19
	2.3.6 "Load" Function	20
	2.3.7 "Save" Function	20
	2.3.8 "Reset" Function	22
	2.3.9 "Screen off" Function	23
	2.4 "ECG" Function	24
	2.4.1 "Heart rate" Parameter	24
	2.4.2 "Frequency" Parameter	24
	2.4.3 "ST Deviation" Parameter	25
	2.4.4 "Pacing" Parameter	25
	2.4.5 "Drift test" Parameter	27
	2.4.6 "Respiration" Parameter	27
	2.4.7 "DC offset" Parameter	30
	2.4.8 "Noise" Parameter	30
	2.4.9 "Load", "Save", and "Reset" Functions	32
	2.5 "Arrhythmia" Function	33
	2.6 "More" Function	35
	2.6.1 "Play Raw" Function	35



	2.6.2 Settings		36
	2.6.2.1	Date/Time Settings	
	2.6.2.2	Backlight Settings	39
	2.6.2.3	Battery Settings	39
	2.6.2.4	Device Information	40
	2.6.2.5	Firmware Update	
3	Calibration a	and Validation	42
4	Cautions		42
5	Ordering Inf	ormation	43
6	Revision Hist	tory	44
7	Contact What	aleTeq	44



List of Tables

Table 1: HECG100 Hardware Overview	8
Table 2: Technical Specifications	9
Table 3: Signal Type	11
Table 4: Signal Add-on	12
Table 5: General Specifications	12
Table 6: Compliance Specifications	13
Table 7: HECG100 Home Screen	15
Table 8: HECG100 Standard Test System	43
Table 9: Optional Accessories	43
Table 10: Optional Calibration Service and Warranty Extension .	44
Table 11: Revision History	44



List of Figures

Figure 1: HECG100 Hardware Overview	. 8
Figure 2: HECG100 Installation	14
Figure 3: HECG100 Home Screen 1	15
Figure 4: "Waveform" Parameter 1	16
Figure 5: "Frequency" Parameter 1	17
Figure 6: "Amplitude" Parameter 1	17
Figure 7: "On/Off" Options of "DC offset" Parameter 1	18
Figure 8: Options of "DC offset" Parameter 1	18
Figure 9: "On/Off" Options of "Noise" Parameter 1	19
Figure 10: "Main Noise" Options of "Noise" Parameter 1	19
Figure 11: "Amplitude" Options of "Noise" Parameter 1	19
Figure 12: "Load" Function	20
Figure 13: Load Previously Saved Waveforms from the micro SD	
Card	20
Figure 14: "Save" Function	21
Figure 15: Save Configured Waveforms to the HECG100 Internal	
Storage	21
Figure 16: Name the Configured Waveform	21
Figure 17: "Successfully Saved" Message of Saving Configured	
Waveforms	22
Waveforms	22 22
Waveforms 2 Figure 18: "Reset" Function 2 Figure 19: "Screen off" Function 2	22 22 23
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2	22 22 23 24
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2	22 22 23 24 24
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2	22 22 23 24 24 25
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2	22 22 23 24 24 25 25
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2	22 23 24 24 25 25 26
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2	22 22 23 24 24 25 25 25 26 26
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2	22 22 23 24 25 25 26 26 27
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2	22 22 23 24 24 25 25 26 26 27 27 27
Waveforms.2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2	22 23 24 24 25 25 26 27 27 28
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 29: "Baseline" Options of "Respiration" Parameter2	22 23 24 25 25 26 27 27 28 28
Waveforms.2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 29: "Baseline" Options of "Respiration" Parameter2Figure 30: "Variation" Options of "Respiration" Parameter2	22 23 24 24 25 25 26 27 27 28 28 28 28
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 29: "Baseline" Options of "Respiration" Parameter2Figure 30: "Variation" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2	22 23 24 25 25 26 27 27 28 28 28 28 29
Waveforms.2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 29: "Baseline" Options of "Respiration" Parameter2Figure 30: "Variation" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 31: "On/Off" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "DC offset" Parameter3	22 23 24 25 25 26 27 28 28 28 28 28 29 30
Waveforms.2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 26: "Drift test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 30: "Variation" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "DC offset" Parameter2Figure 33: Options of "DC offset" Parameter3Figure 33: Options of "DC offset" Parameter3	22 23 24 25 25 26 27 28 28 28 28 28 29 30
Waveforms2Figure 18: "Reset" Function2Figure 19: "Screen off" Function2Figure 20: "Heart rate" Parameter2Figure 21: "Frequency" Parameter2Figure 22: "ST Deviation" Parameter2Figure 23: "On/Off" Options of "Pacing" Parameter2Figure 24: "Amplitude" Options of "Pacing" Parameter2Figure 25: "Duration" Options of "Pacing" Parameter2Figure 26: "Dirft test" Parameter2Figure 27: "On/Off" Options of "Respiration" Parameter2Figure 28: "Rate" Options of "Respiration" Parameter2Figure 30: "Variation" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 31: "Apnea" Options of "Respiration" Parameter2Figure 32: "On/Off" Options of "Respiration" Parameter2Figure 33: Options of "DC offset" Parameter3Figure 34: "On/Off" Options of "Noise" Parameter3	22 23 24 25 26 27 28 28 28 29 30 31



Figure 35: "Main Noise" Options of "Noise" Parameter	31
Figure 36: "Amplitude" Options of "Noise" Parameter	31
Figure 37: "Load", "Save", and "Reset" Functions	32
Figure 38: "Arrhythmia" Function	33
Figure 39: Select a Desired Arrhythmia Waveform for Testing	33
Figure 40: Play the Desired Arrhythmia Waveform for Testing	34
Figure 41: "Play Raw" Function	35
Figure 42: Raw Data Files for Playback	36
Figure 43: Settings	36
Figure 44: Date/Time Settings	37
Figure 45: Date Setting	37
Figure 46: Time Setting	37
Figure 47: Date Format Setting	38
Figure 48: Time Format Setting	38
Figure 49: Backlight Settings	39
Figure 50: Battery Settings	39
Figure 51: "Auto Power Off" Options	40
Figure 52: Device Information	40
Figure 53: Firmware Update (step 4)	41
Figure 54: Firmware Update (step 5)	41



1 Introduction

1.1 Overview

The HECG100 is a handheld 12-lead ECG simulator that generates singlechannel signals for testing a wide range of ECG devices, including ECG machines, patient monitors, Holter monitors, and others. Among different usage scenarios, the HECG100 features powerful functions to address the challenges during product development and verification.

<u>R&D</u>

Engineers require specialized specification verification and regression tests for each design modification. Therefore, the HECG100 provides advanced functions to accelerate the verification process.

- **Raw Data Playback** quickly verify designs with designated raw data
- Automated Quick Testing streamline workflows and shorten test cycles by using custom test sequences without repetitive setups and coding
- Advanced ECG and Add-on Signals provide a database of 32 arrhythmias, and a full suite of DC offset, noise, pacing, and respiration simulation for superimposing to configured ECG waveforms
- Quick Test Launch reduce setup time from minutes to seconds

Compliance Testing

In EMC test environments, engineers struggle with shielding workarounds to ensure stable ECG testing signals and mitigate mains frequency noise introduced by ECG simulators. Accordingly, the HECG100 comes with practical strategies to solve these challenges.

- Battery-powered ECG Testing no mains frequency noise interference
- EMI & EMS Compliant Design ensure stable signal output in high-EMI environments while eliminating testing uncertainty
- **ESD Protection** handle errant electrostatic discharges without interrupting testing
- 12-hour Continuous Testing flexibility for extended compliance evaluations



1.2 Hardware Overview







Table 1: HECG100 Hardware Overview

Item	Name	Description
		To select "Waveform" (F1 button),
1	Function Buttons	ECG (F2 button), Arrnythmia (F3
		button) and More (F4 button)
		functions.
2	LCD Screen	To show parameter settings.
3	Electrode Terminals	To connect to electrodes on DUT.
1	Arrow Keys and Enter	To select and confirm parameter
4	Кеу	settings.
5	Power Button	To turn on and turn off the HECG100.



Item	Name	Description
6	Monitor Port	To connect to an oscilloscope to monitor the amplified ECG signal output (1mV=1000mV output).
7	Reset Button	To reset the HECG100.
8	SD Card Slot	To put the provided micro SDHC card.
9	USB-C Port	To connect to a computer or an adaptor for charging.

1.3 Specifications

• Technical Specifications

Table 2: Technical Specifications

Parameters	Specifications
Heart rate accuracy	±1%
Amplitude accuracy	±2%
Frequency / pulse repetition rate accuracy	±1%
Pulse duration accuracy (excluding pacing)	±0.5ms
ECG duration accuracy	±0.5ms
Pacing pulse width accuracy	±5µs
Pacing pulse amplitude accuracy, range	±2mV pulse: ±0.3% >2mV pulse: ±10%
Pacing pulse characteristics	Rise/fall time 5µs Overshoot <1% Settling time <1%
Capacitor tolerance	±5%



Parameters	Specifications
Sample rate	10kHz ± 0.05%
RCA output amplitude range	ECG electrode output x1000, max 10V
RCA output amplitude accuracy	±1% for amplitudes of 0.5Vpp or higher
Lead output ratio	Reference lead (lead II) in a certain ratio (calculated in percentage). Lead I: 70 (if RA=100, LA=170) Lead II: 100 (LL=200) Lead III: 30 (CT=(100+170+200)/3=156.7) Lead V1: 24 (V1=24+156.7=180.7) Lead V2: 48 (V2=204.7) Lead V3: 100 (V3=256.7) Lead V3: 100 (V3=256.7) Lead V4: 120 (V4=276.7) Lead V5: 112 (V5=268.7) Lead V6: 80 (V6=236.7)
Total harmonic distortion	5%
Signal noise ratio	≥60dB
DC offset	Setting ±1% (fixed, may include up to 50μVpp noise)
Respiration Simulation Accura	асу
Impedance baseline	±5%
Impedance variations ($\Delta \Omega$)	$\pm(5\% \text{ of setting}) + 0.05\Omega$



• Signal Type

Table	3:	Signal	Type
	•••	0.Ba.	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

Parameters		Specifications
ECG	Heart rate	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300BPM
waveform	Amplitude	0.1, 0.5, 1, 2, 3, 4, 5mVpp
	ST deviation	-0.6-0.6mV
Sine	Frequency	0.1, 0.5, 0.67, 1, 2, 5, 10, 20, 40, 50, 60, 100, 150, 200Hz
	Amplitude	0.1, 0.5, 1, 2, 3, 4, 5mVpp
Trianglo	Frequency	1, 2Hz
Thangle	Amplitude	0.5, 1, 2mVpp
Squaro	Frequency	0.125, 1, 2Hz
Square	Amplitude	0.1, 0.5, 1, 2, 3, 4, 5mVpp
Doctoralo	Frequency	30, 60, 120BPM
Rectangle	Pulse width	40, 60, 100, 200ms
puise	Amplitude	0.1, 0.5, 1, 2, 3, 4, 5mV
Trianglo	Frequency	30, 60, 120BPM
nulse	Pulse width	40, 60, 100, 200ms
Paise	Amplitude	0.1, 0.5, 1, 2, 3, 4, 5mV



• Signal Add-on

	Parameters	Specifications
DC offset		±300, ±500, ±1000mV
	Amplitude	1, 2, 5, 10, 20, 50, 100mV
Pacing	Duration	0.1, 0.5, 1.0, 1.5, 2.0, 3ms
	Pacing rate	Synchronization
Drift test		Triangle wave (0.1Hz, 4mVpp)
Noiso	Main noise	50Hz, 60Hz, White noise
Noise	Amplitude	1, 2, 5, 10mVpp
	Frequency	15, 20, 30, 40BrPM
	Baseline	500Ω, 1000Ω, 1500Ω
Respiration	Ratio (inspiration:expiration)	1:1
	Variation	1Ω, 2Ω, 5Ω
	Apnea	12s, 22s, 32s, continuous, off
Play raw data Sample rate		Maximum: 10kHz (able to play repeatedly)

Table 4: Signal Add-on

• General Specifications

Table 5: General Specifications

Items	Specifications
Temperature	Operating: 10°C—40°C (50°F— 104°F) Storage: 0°C—50°C (32°F—122°F)
Humidity	10%-90% non-condensing
Altitude	Up to 2000m
Communications	USB Type-C connector



Items	Specifications
Power	5V DC
Battery charger	5V, 1A
Battery life	12 hours (continuous testing in power-saving mode)
Mechanical	Housing: ABS Plastic Size (L x W x H): 18.0 x 12.8 x 5.5cm Weight: 950g
Data capacity	32GB micro SD card

• Compliance Specifications

Table 6: Compliance Specifications

Items	Specifications
FCC	EMC P15B
CE	 EMC EN61326-1 ESD 8kV (contact), 15kV(air) EMI Class A, Class B Safety IEC/EN61010-1:2010 + A1:2016; Pollution degree 2 61010-2-030:201



2 Installation and Settings

2.1 Installation



Figure 2: HECG100 Installation

- 1. Connect the electrodes of DUT respectively to the electrode terminals on the HECG100. For example, connect the RA, LA, and LL electrodes respectively to the RA, LA, and LL electrode terminals.
- 2. Press the power button on HECG100 to turn it on and start to test.



2.2 Home Screen

After powering on the HECG100, users will see the figure below on its screen.

			3 4 21:30 @	
	Wave		Sine >	
	Frequency		1 Hz >	
	Amplitude		1 mV >	
2	DC Offset 0 mV		On >	5
	Noise 60 Hz / 1 mV		On >	
	Waveform ECG	Arrhythmia	More	

Figure 3: HECG100 Home Screen

Item	Name	Description
1	Functions	Switch between "Waveform", "ECG", "Arrhythmia" and "More" functions using F1, F2, F3, and F4 buttons respectively.
2	Sidebar	Use the arrow key (◀) on HECG100 to expand the sidebar for "Load", "Save", "Reset" and "Screen off" functions.
3	Time	To show the current time.
4	Battery Level	To show the current battery level.
5	Parameters	To show parameter selections according to the designated function.

Table 7: HECG100 Home Screen



2.3 "Waveform" Function

Users can configure a desired standard waveform for testing through the "Waveform" function.

2.3.1 "Wave" Parameter

The HECG100 provides sine, triangle, square, rectangle pulse, and triangle pulse waveforms for users to select.

Note: If users select rectangle pulse and triangle pulse waveforms, the "Width" parameter will show under the "Frequency" parameter.

				21:30 🎟
	Wave	Sine >	W	/aveform
<	Frequency	1 Hz >		
	Amplitude	1 mV >		
	DC Offset	On >		
	0 mV			Sine
	Noise	On >	5	Square
	60 Hz / 1 mV		Т	riangle
			Recta	ingle Pulse
1	Waveform ECG	Arrh	ythmia	More

Figure 4: "Waveform" Parameter



2.3.2 "Frequency" Parameter

The options under "Frequency" parameter vary according to the designated waveform.

						21:30	
	Wave		Sine	>	Fr	equency	
	Frequency		1 Hz	>	C).1	
	Amplitude		1 mV	>	C).5	
<	DC Offset		On	>	0.	67	
	0 mV					1 Hz	
	Noise		On	>		2	
	60 Hz / 1	mV				5	
						10	
١	Vaveform	ECG	Ar	rhy	thmia	More	
		- "-			_		

Figure 5: "Frequency" Parameter

2.3.3 "Amplitude" Parameter

The options under "Amplitude" parameter vary according to the designated waveform.

					21:30	
	Wave		Sine >	An	nplitude	
	Frequency	,	1 Hz >			
	Amplitude	: 1	mV >			
<	DC Offset		On >			_
	0 mV				1 mV	
	Noise		On >		2	
	60 Hz / 1	mV			3	
					4	
N	Waveform	ECG	Arrhy	thmia	More	2

Figure 6: "Amplitude" Parameter



2.3.4 "DC offset" Parameter

Users can select "On" to superimpose the DC offset signal to the designated waveform.

						21:30	
	Wave		Sine	>	On		>
	Frequency		1 Hz	>	Offset		>
<	Amplitude		1 mV	>			
	DC Offset 0 mV		On	>			
	Noise 60 Hz / 1 m	v	On	>			
Waveform ECG		ECG	Ar	rhy	thmia	More	

Figure 7: "On/Off" Options of "DC offset" Parameter

				21:30	
	Wave	Sine >		Offset	
	Frequency	1 Hz >	-10	00	
	Amplitude	1 mV >	-50	00	
	DC Offset	On >	-30	00	
Ì	0 mV			0 mV	
	Noise	On >	+30	00	
	60 Hz / 1 mV		+50	00	
			+100	00	
1	Waveform E	CG Arrhy	thmia	More	•

Figure 8: Options of "DC offset" Parameter



2.3.5 "Noise" Parameter

Users can select "On" to superimpose the noise signal with main noise and amplitude options to the designated waveform.

					21:30	
	Wave	S	ine >	On		>
	Frequency	1	Hz >	Main	Noise	>
<	Amplitude	1 r	nV >	Ampli	tude	>
	DC Offset 0 mV	(On >			
	Noise 60 Hz / 1 mV	/	On >			
1	Waveform	ECG	Arrhy	thmia	More	

Figure 9: "On/Off" Options of "Noise" Parameter

						21:30	
	Wave		Sine 3	>	Ma	ain Noise	
	Frequency		1 Hz 🔅	>			
	Amplitude		1 mV 🔅	>			
	DC Offset		On 3	>		50	
`	0 mV					60 Hz	
	Noise 60 Hz / 1 r	nV	On 3	>		White	
Waveform ECG		ECG	Arr	hyt	thmia	More	

Figure 10: "Main Noise" Options of "Noise" Parameter

					21:30	
	Wave	S	ine ≻	Ai	mplitude	
	Frequency	1	Hz >			
	Amplitude	1	mV >			
2	DC Offset		On >			
Ì	0 mV				1 mV	
	Noise		On >		2	
	60 Hz / 1	mV			5	
				· ·	10	
Waveform E		ECG	Arrhy	thmia	More	

Figure 11: "Amplitude" Options of "Noise" Parameter



2.3.6 "Load" Function

Users can load previously saved waveforms from the HECG100 internal storage or the micro SD card for testing.

	21:30 💷
🖹 Load	Sine >
📥 Save	1 Hz >
C Reset	1 mV >
>	On >
	On >
💋 Screen Off	
Waveform ECC	G Arrhythmia More

Figure 12: "Load" Function

Load			21:30 🚥
Internal Storage	>	2024_01	>
SD Card	>	2024_02	>
		20240011	3.ecg
		20240011	4.ecg
		20240011	5.ecg
		20240011	6.ecg
		20240011	7.ecg
		20240011	2.eca
Cancel			Okay

Figure 13: Load Previously Saved Waveforms from the micro SD Card

2.3.7 "Save" Function

Users can save configured waveforms to the HECG100 internal storage or the micro SD card for future testing.

Note: Users can create new folders for the internal storage and micro SD card to categorize waveforms.





Figure 14: "Save" Function



Figure 15: Save Configured Waveforms to the HECG100 Internal Storage

Sav	e									21	:30	(
Fi	File Name Enter file name									.ee	cg	
А	в	с	D	Е	F	G	н	I	J	к	L	М
Ν	0	Р	Q	R	S	Т	U	۷	w	х	Y	Ζ
1	2	3	4	5	6	7	8	9	0			
♠	#	-		,	-	[]					
Clear All			I	Space				Ba	acks	spac	e	
Cancel				Ba	ck					\$	Save	9

Figure 16: Name the Configured Waveform



Save	2	21:30 🚥
File Name	ABC	.ecg
Success! The file "A	BC" has been successfully s	۸ aved.
Clear All	Space Back	space
		Okay

Figure 17: "Successfully Saved" Message of Saving Configured Waveforms

2.3.8 "Reset" Function

Users can reset the settings of a configured waveform.





2.3.9 "Screen off" Function

If users select the "screen off" function, the HECG100 will be in powersaving mode.

By pressing any button on the HECG100, it will return to normal operation.



Figure 19: "Screen off" Function



2.4 "ECG" Function

Users can configure a desired ECG waveform for testing through the "ECG" function.

2.4.1 "Heart rate" Parameter

Select the desired heart rate value for the ECG waveform.



Figure 20: "Heart rate" Parameter

2.4.2 "Frequency" Parameter

Select the desired frequency value for the ECG waveform.



Figure 21: "Frequency" Parameter



2.4.3 "ST Deviation" Parameter

					21:30	
	Heart Rate	60 bpm	>	STI	Deviatior	ı
	Amplitude	1 mV	>	-0	.3	
	ST Deviation	0 mV	>	-0.	.2	
	Pacing	On	>	-0	.1	
Ì	1 mV / 2.0 ms	s / Sync			0 mV	
	Drift Test	On	>	0	.1	
	4 mV / Triang	le		0	.2	
	Resp.	Off	>	0	.3	
١	Waveform E	/thmia	More			

Select the desired ST deviation value for the ECG waveform.

Figure 22: "ST Deviation" Parameter

2.4.4 "Pacing" Parameter

Users can select "On" to superimpose the pacing signal with amplitude and duration options to the configured waveform.

Note: When using the pacing signal, users need to disable the respiration simulation.







					21:30	
	Heart Rate	e 60 bpr	n >	A	mplitude	
	Amplitude	1 m	v >			
	ST Deviati	on 0 m'	v >			
2	Pacing	0	n >			
Ì	1 mV / 2.	0 ms / Sync			1 mV	
	Drift Test	0	n >		2	
	4 mV / Tr	riangle			5	
	Resp.	Of	ff >		10	
١	Waveform	ECG	ECG Arrh		More	2

Figure 24: "Amplitude" Options of "Pacing" Parameter



Figure 25: "Duration" Options of "Pacing" Parameter



2.4.5 "Drift test" Parameter

Users can select "On" to superimpose a triangle waveform (0.1Hz, 4mVpp) to the configured waveform for testing baseline drift.

			21:30 📟
	Heart Rate	60 bpm >	On >
	Amplitude	1 mV >	4 mV / Triangle
	ST Deviation	0 mV >	
<	Pacing 1 mV / 2.0 m	On >	
	Drift Test 4 mV / Trian	On > gle	
	Resp.	Off >	
١	Waveform	ECG Arr	rhythmia More

Figure 26: "Drift test" Parameter

2.4.6 "Respiration" Parameter

Users can select "On" to superimpose the respiration signal with rate, baseline, variation and apnea options to the configured waveform.

Note: When using the respiration signal, users need to disable the pacing and DC offset simulation.



Figure 27: "On/Off" Options of "Respiration" Parameter





Figure 28: "Rate" Options of "Respiration" Parameter



Figure 29: "Baseline" Options of "Respiration" Parameter



Figure 30: "Variation" Options of "Respiration" Parameter



					21:30 🚥
	Pacing	Of	f>		Apnea
	Drift Test	0	n >		
	4 mV / Tr	riangle			12
	Resp.	O	n >		22
Ì	15 BrPM	/ 1000 ohm	/		32 s
	1:1 / 1 oł	nm / 32 s		Co	ontinuous
	DC Offset	Of	f>		Off
	Noise	Of	f >		
١	Vaveform	ECG	Arrh	ythmia	More

Figure 31: "Apnea" Options of "Respiration" Parameter



2.4.7 "DC offset" Parameter

Users can select "On" to superimpose the DC offset signal to the configured waveform.

Note: When using the DC offset signal, users need to disable the respiration simulation.



Figure 32: "On/Off" Options of "DC offset" Parameter

					21:30	
Pacing		On	>		Offset	
1 mV / 2	0 ms / Syi	nc		-10	00	
Drift Test		On	>	-5	00	
4 mV / Ti	riangle			-3	00	
Resp.	(Off	>		0 mV	
DC Offset		On	>	+3	00	
0 mV				+5	00	
Noise		Off	>	+10	00	
Waveform	ECG	A	Arrh	ythmia	More	9
	Pacing 1 mV / 2. Drift Test 4 mV / Tr Resp. DC Offset 0 mV Noise Waveform	Pacing 1 mV / 2.0 ms / Syn Drift Test 4 mV / Triangle Resp. DC Offset 0 mV Noise Waveform ECG	Pacing On 1 mV / 2.0 ms / Sync Drift Test On 4 mV / Triangle Resp. Off DC Offset On 0 mV Noise Off Waveform ECG /	Pacing On 1 mV / 2.0 ms / Sync Drift Test On 4 mV / Triangle Resp. Off DC Offset On 0 mV Noise Off Waveform ECG Arrhy	Pacing On -100 1 mV / 2.0 ms / Sync -100 Drift Test On > -50 4 mV / Triangle -30 Resp. Off > DC Offset On > 0 mV +50 Noise Off > Waveform ECG	21:30 Pacing On > 1 mV / 2.0 ms / Sync -1000 Drift Test On > 4 mV / Triangle -300 Resp. Off > 0 mV +300 0 mV +500 Noise Off > +1000 +000

Figure 33: Options of "DC offset" Parameter

2.4.8 "Noise" Parameter

Users can select "On" to superimpose the noise signal with main noise and amplitude options to the configured waveform.





Figure 34: "On/Off" Options of "Noise" Parameter



Figure 35: "Main Noise" Options of "Noise" Parameter



Figure 36: "Amplitude" Options of "Noise" Parameter



2.4.9 "Load", "Save", and "Reset" Functions

In the sidebar of ECG function, user can also load, save, and reset configured waveforms.

Please refer to "2.3.6"Load" Function", "2.3.7 "Save" Function", and "2.3.8"Reset" Function" for more information.



Figure 37: "Load", "Save", and "Reset" Functions



2.5 "Arrhythmia" Function

The HECG100 provides a database of 32 arrhythmia waveforms categorized as sinus rhythm, premature beat, flutter and fibrillation, conduction block, and bundle branch block for testing.



Figure 38: "Arrhythmia" Function

					21:30			
	Sinus Rhyth	nm nus F		Sinus Rhy	rthm	1		
	Premature Flutter and	Beat Fibril						
<	Conduction	Bloc	Normal Sinus Rhythm					
	Bundle Bra	nch E	Sinus Bradycardia					
			Sinus Tachycardia					
			Sinus Arrhythmia					
Waveform EC		ECG	Arrhythmia More					

Figure 39: Select a Desired Arrhythmia Waveform for Testing



Ar	rhythmia	21:30 🚥
	Sinus Rhythm Normal Sinus Rhythi (Max Amplitude = 1.0 m)	m /)
<	$-\sqrt{\mu}-\sqrt{\mu}-\sqrt{\mu}-\sqrt{\mu}$	\sim
	0	0:00 / 00:10
	Back Stop Loop	Play

Figure 40: Play the Desired Arrhythmia Waveform for Testing



2.6 "More" Function

In the "More" function, users can perform the play raw data function and configure general settings of the HECG100.

2.6.1 "Play Raw" Function

The play raw data function allows users to test using their own waveforms. Please follow the steps below to perform this function:

- 1. Store waveforms in the provided micro SD card.
- 2. Insert the micro SD card to the HECG100 for reading and testing.

Note:

- (1) The micro SD card supports storage of at least 100 raw data files with each file containing 20 seconds of data sampled at 10kHz. The number of files that can be stored may vary depending on the file length.
- (2) If users encounter any issues when enabling this function, please contact WhaleTeq.



Figure 41: "Play Raw" Function



F	Play Raw 21:30		
	20240113.txt	00:10 s	
<	20240114.txt	00:08 s	
	20240115.txt	00:05 s	
	20240116.txt	00:05 s	
	20240117.txt	00:05 s	
	20240118.txt	00:05 s	
	20240115 000	00.05 0	
	20240113	00:00 / 00:10	
	Back Stop Loop	Play	

Figure 42: Ra	w Data Fil	es for Playback
---------------	------------	-----------------

2.6.2 Settings

In the "Settings" function, users can configure "Date/Time" and "Backlight", and check "Battery", "Device Information", and "Firmware update" information.

S	Setting 21:30			
Π	Date/Time		>	
	Backlight		>	
	Battery		>	
2	Device Information		>	
	Firmware update		>	
			_	
	Back	Okay		
	Figure 43: Settings			

2.6.2.1 Date/Time Settings

In the "Date/Time" settings, users can configure "Date", "Time", "Date Format", and "Time Format" of the HECG100.



Setting		21:30 📟
	Date	08/26/2024 >
	Time	8:35:25 >
	Date Format	MM/DD/YYYY >
<	Time Format	24 hour >
	Back	Okay



S	Setting 21:30 III		
	Month	Day	Year
	05	23	2021
	06	24	2022
	07	25	2023
Ì	08	26	2024
	09	27	2025
	10	28	2026
	11	29	2027
	Back Okay		

inguic 43. Dute setting	Figure	45:	Date	Setting
-------------------------	--------	-----	------	---------

Setting 21:30 I			
Hour	Minute	Second	
05	32	22	
06	33	23	
07	34	24	
08	35	25	
09	36	26	
10	37	27	
11	38	28	
Back	Back Okay		

Figure 46: Time Setting





Figure 47: Date Format Setting



Figure 48: Time Format Setting



2.6.2.2 Backlight Settings

In the "Backlight" settings, users can select "Low", "Medium", and "High" for the LCD screen brightness.



2.6.2.3 Battery Settings

In the "Battery" settings, users can select the time for "Auto Power Off" and check the percentage of battery level.

S	Setting	21:30 📟
	Battery	
	Auto Power Off	>
	Battery	100%
<		
	Deale	
	Васк	Okay

Figure 50: Battery Settings





Figure 51: "Auto Power Off" Options

2.6.2.4 Device Information

Users can check information such as model, firmware version, serial number, last calibration date, and play raw data license in this section.

Setting		21:30 💷
	Device Information	
	Model	HECG100
	Firmware Version	2.02.01
2	Serial Number	3071053
	Last Calibration	03/03/2015
	Play Raw License	No
	Back	





2.6.2.5 Firmware Update

Please follow the steps below to update the firmware:

1. Visit the <u>HECG100 product page</u> to download the firmware update tool.

2. Install the tool to your computer and connect HECG100 to the computer.

3. Activate the tool.

4. Right click on the title bar and select "Check for Updates" to check whether a new firmware version is available.

5. The "Update" window will show "A new version is available" if a new firmware version is detected. Click "Yes" to update.

6. Reboot the HECG100 after updating the firmware.



Figure 53: Firmware Update (step 4)



Figure 54: Firmware Update (step 5)



3 Calibration and Validation

It is recommended to calibrate the HECG100 annually. Calibration and validation both require traceable equipment. Steps for calibration and validation methods are available upon request. Please contact WhaleTeq for more details (see section 7).

4 Cautions

- Before using the HECG100 for the first time, please charge it for at least 3 hours.
- 2. When the battery level icon displays "¹, the HECG100 has a low battery. Please charge it as soon as possible.
- 3. The built-in battery must be kept from high temperatures (above 60°C) and open flames. Do not disassemble or short-circuit the HECG100.
- 4. The HECG100 is designed with ESD protection; however, when ESD testing is performed on the DUT, electrostatic discharge should not be applied directly to the HECG100 using the ESD gun.
- 5. For routine cleaning, use a slightly damp cloth with a neutral soap solution to wipe the external casing, and avoid getting moisture inside the HECG100. Do not use corrosive agents, isopropyl alcohol, or solvents for cleaning.



5 Ordering Information

Standard Test System

Part No.	Image	Description	Quantity
100-EC00007		Model No.: HECG100 Model Name: Handheld 12-lead ECG Simulator Package contents: • HECG100 x 1 • RCA male to BNC cable (74cm, black) x 1 • USB Type-C to Type-C cable (male to male, 60cm, black) x 1	1
		 32GB micro SDHC card x 1 	

Table 8: HECG100 Standard Test System

Optional Accessories

Table 9: Optional Accessories

Part No.	Image	Description	Quantity
K21-0738302	\bigcirc	RCA male to BNC cable (74cm) (black)	1
K27-0600301	\bigcirc	USB Type-C to Type-C cable (male to male) (60cm) (black)	1
S71-0201011		32GB micro SDHC card	1





Optional Calibration Service and Warranty Extension

Table 10: Optional Calibration Service and Warranty Extension

Part No.	Description	
	Model No.: C3	
VV0007	Provides (3) years of calibration service coverage.	
110007	WhaleTeq equipment can be calibrated to original	
	performance on the basis of (1) year interval.	
VV/0008	Model No.: R3	
110008	Extends the limited warranty from (1) year to (3) years.	

6 Revision History

Table 11: Revision History

Version	Description	Issue Date
2025-03-06	First version	2025-03-31

7 Contact WhaleTeq

WHALETEQ Co., LTD	
<u>service@whaleteq.com</u> (O)+886 2 2517 6255	
8F., No. 125, Songjiang Rd., Zhongshan Dist., Taipei City 104474, Taiwan	