

# WHALETEQ

## DFS100

### User Manual



Revision 2021-08-03

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WhaleTeq Co. LTD

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# 1 Introduction

## 1.1 Concept

WhaleTeq DFS100 is designed for AED field tester. AED (Automated External Defibrillator) is a life-saving medical device that delivers defibrillation upon identifying and analyzing the ECG of a resuscitation-needed patient. Because AEDs are installed in public areas where they can be reached before ambulance arrival, the majority of AEDs rely on one-time batteries and requires only minimal training compared to hospital-use defibrillators. Ensuring the functionality of AEDs periodically becomes widely accepted around the world, and DFS100 is the ideal tool to conduct such a regular inspection.

## 1.2 Applications

WhaleTeq DFS100 is a compact field tester, functioning as an ECG signal simulator and defibrillation energy guarantee equipment for AED regular maintenance.

For ECG patterns simulation, DFS100 simulates NSR (Normal Sinus Rhythm) as well as other arrhythmias that may need AED defibrillation. Arrhythmia convert combination (ECG waveform before vs. after defibrillation) is also available.

For energy guarantee, DFS100 allows User to customize the pass/fail criteria of the delivered defibrillation energy. To ensure the durability of DFS100, protection against multiple defibrillation is implemented. (DFS100 should be used to analyze defibrillation energy at the interval of at least 60 seconds)

## 2 Specification

### 2.1 General Specifications

Table 1: General Specifications

Function	Spec (DFS100)
Temperature	Operating: 0 °C to 50 °C (+32 °F to +122 °F)
	Storage: -20 °C to +60 °C (-4 °F to +140 °F)
Humidity	10 % to 90 % non-condensing
Communications	USB only Type C connector
Operation Modes	Manual
Power	9V Battery*1 (no charger)
Mechanical	Housing: ABS Plastic
	Size (L x W x H): 17.0 x 8.55 x 4.0 (cm)
	Weight: 330 g
Safety Standards	CE: IEC/EN61010-1:2010 + A1:2016; Pollution degree 2 61010-2-030:2017
Electromagnetic Compatibility Standards (EMC)	FCC: EMC P15B

### 2.2 Energy Measurement Specifications

Table 2: Energy Measurement Specifications

Function	Spec (DFS100)
Maximum Energy	Up to 600 J
Accuracy	± 1 % of reading ± 1 J
Load Resistance	Resistance: 50 Ω
	Accuracy: ±1 %, non-inductive (<2 μ H)
Pulse Trigger Level	60V



Function	Spec (DFS100)
Pulse Width	Range: 1.0 to 50.0 ms Accuracy: $\pm 0.1$ ms
Voltage	Range: Up to 5000 V Accuracy: $\pm (1\% \text{ of reading} + 2 \text{ V})$ Note: 5000V is the $V_p$
Sample rate	100 kHz (10 $\mu$ s sample)
Maximum Average Power	12 W, equivalent to 1 defib. pulses of 360 J every 30 seconds
DFS Battery Level	Low power alert

## 2.3 ECG Signal Specifications

Table 3: ECG Signal Specifications

Function	Spec (DFS100)
Waves	Ventricular Fibrillation - Coarse Ventricular Tachycardia ( $\geq 230$ BPM)
Normal Sinus Rhythm (NSR)	Set at 80 BPM, $V_{p-p} = 3$ mV
Sample rate	5 kHz (200 $\mu$ s sample)
Amplitude	0 – 5 mV ( $V_{p-p} 5mV$ )

### 3 Instrument Familiarization

#### 3.1 Top

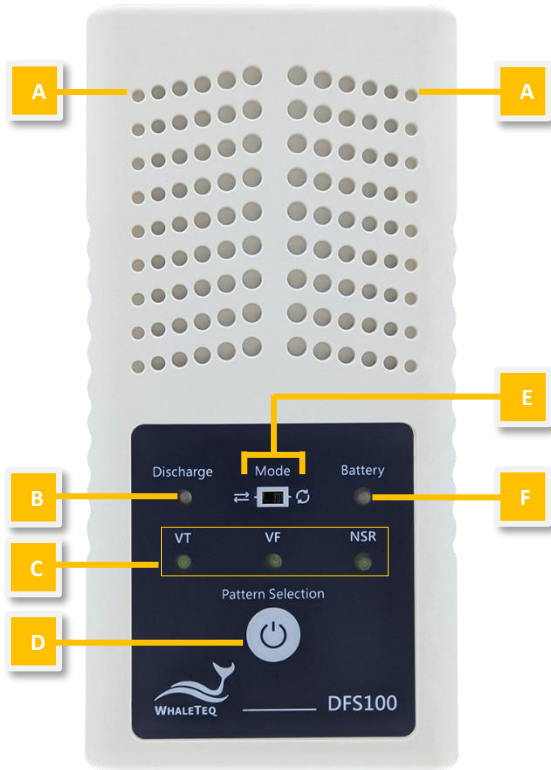


Figure 1: Top Side of DFS100

- A. **Ventilation Holes:** Allow ventilation during operation. Keep this side up when in use.
- B. **AED Discharge LED:**

Table 4: AED Discharge LED

Scenario	LED behavior
No Discharge	No light
Discharge Detected (Pass)	If the discharge value equals to or is greater than the joule number set in 5.1 (C), the green light continues for 30 seconds, during which Pattern Selection Button (D) has no function.



Scenario	LED behavior
Discharge Detected (Fail)	If the discharge value is less than the joule number set in 5.1 (C), the red light continues for 30 seconds, during which Pattern Selection Button (D) has no function.

- C. **ECG Pattern:** There are 3 ECG patterns to choose from: VT (Ventricular Tachycardia), VF (Ventricular Fibrillation), or NSR (Normal Sinus Rhythm).
- D. **On/Off and Pattern Selection Button:**

Table 5: On/Off and Pattern Selection Button

Scenario	Button behavior
On	Press the button for about 1 second to turn on DFS100.
Pattern Selection	When DFS Battery LED (F) indicates DFS100 is on, the button function becomes pattern selection.
Off	Long press the button for 3 seconds to turn off DFS100. Alternatively, after DFS100 idles for 3 minutes, it'll automatically be turned off. The length of idle time can be customized via PC software described in 5.1 (D).

E. **Mode Switch:**

- a. **Mode 1:** One-Time Test (Convert) 
- b. **Mode 2:** Continuous Arrhythmia 

F. **DFS Battery LED:**

Table 6: DFS Battery LED

Mode	Power On	Low Power
Standalone Operation	Green light blinks every 2 seconds.	Red light blinks every 2 seconds.
AP connected	Green light (always on)	Red light (always on)

### 3.2 Front and Rear

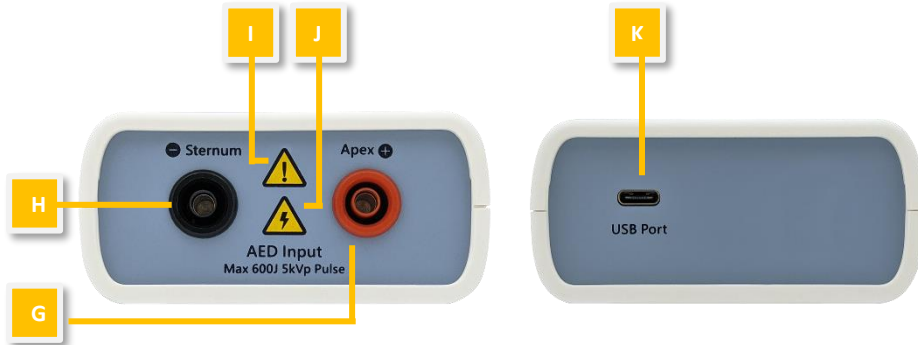


Figure 2: Front and Rear Side of DFS100

- G. AED Interface Jack (Apex):** Connect the Apex jack to the AED pad labeled Apex via DFS accessory “AED Interface Cable”.
- H. AED Interface Jack (Sternum):** Connect the Sternum jack to the AED pad labeled Sternum via DFS accessory “AED Interface Cable”.
- I. Caution:** DFS100 is recommended to be used for analyzing defibrillation shock at the interval of at least 60 seconds apart.
- J. Caution, the possibility of electric shock:** From the time AED starts charging for defibrillation until right after energy delivery, User is recommended to stay clear from DFS100.
- K. USB Port:** Connect to the computer’s USB port for data transferring.

### 3.3 Back

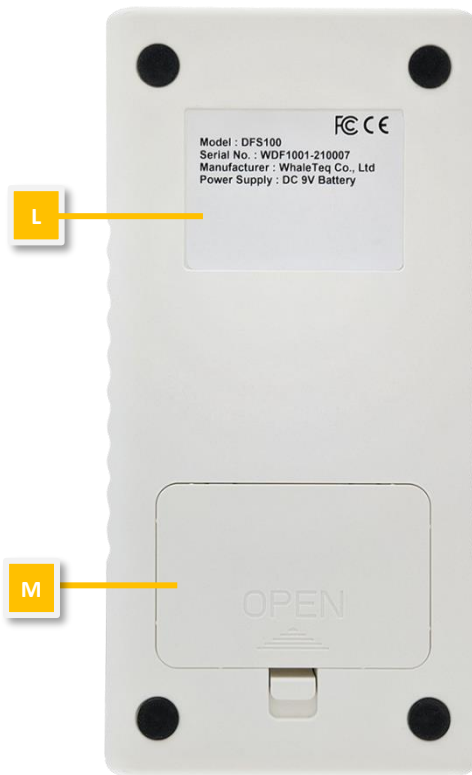


Figure 3: Back Side of DFS100

- L. Label:** Contain information including model, serial number, manufacturer, and power supply.
- M. Battery Compartment:** Insert a 9V battery for power supply. Both disposable batteries and rechargeable batteries can be used.

### 3.4 Wiring Diagram

#### DFS100 Scenario

Shock P/F Only

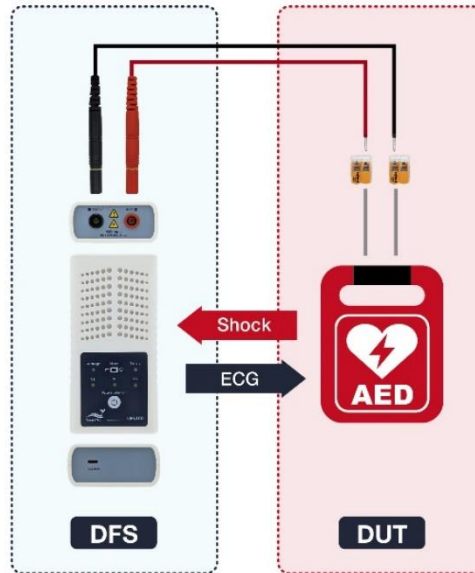


Figure 4: Wiring Diagram

#### Note:

To plug in properly, please make sure the yellow lines on the black and red banana males that connect to DFS100 totally disappear in the jacks.

## 4 Getting Started

### 4.1 PC System Requirements

DFS100 Setup Software uses a Windows PC to connect and modify DFS100 via USB module.

PC requirements:

- Windows PC (Windows 7 or later, suggest to use the genuine version)
- Microsoft .NET 4.0 or higher
- Administrator access (essential for installing software, driver, and Microsoft .Net Framework)
- 1.5 GHz CPU or higher
- 1GB RAM or higher<sup>1</sup>
- USB port

### 4.2 Software Installation

Please follow the steps below to download and execute DFS software.

1. Download DFS100 software from WhaleTeq's website.
2. Open the file explorer and select the download location.
3. Double click on *WhaleTeqDFS100.exe* to execute DFS100 PC software.

**Note:**

If DFS software cannot be executed properly, or this is the first time using WhaleTeq's product, please refer to the two sections below (4.3 and 4.4) to confirm that the USB driver and Microsoft .Net Framework 4.0 are both installed.

---

<sup>1</sup> Relative to normal PC processing, there is no special use of PC speed. However, there has been noted a slow increase in system RAM usage over long periods of time up to 30-40MB (related to MS Windows "garbage collection"). PCs with only 512MB or less installed and are running several other programs (in particular, Internet Explorer), may exceed the available RAM, requiring access to the hard drive and dramatically impacting speed. In this case, streaming interruptions and other problems may occur.

### 4.3 USB Driver Installation

If Windows Device Manager can't recognize WhaleTeq's product, please follow the instructions below to install Microchip® USB Driver.

#### For Microsoft Windows 10

- As Windows 10 has built-in Microchip® USB Driver, there is no need to install any drivers. It just takes a while for Windows Device Manager to recognize and install the driver.

#### For Microsoft Windows 8 and Windows 8.1

- If Windows 8 and Windows 8.1 can't recognize DFS100 unit, please download "[mchpcdc.inf](#)" from WhaleTeq's website. This driver is provided by Microchip®, and is intended to be used with PIC microprocessors which have built-in USB functions.
- As mchpcdc.inf provided by Microchip® does not contain a digital signature, please disable the driver signature enforcement in Windows 8 and Windows 8.1. Please click [here](#) to watch the tutorial video.
- When the USB module is connected for the first time, select Manual Installation, and point to the folder containing the above file. Then, continue to follow the instructions to finish the installation. There may be a warning that the driver is not recognized by Windows®, and this can be ignored. Please click [here](#) to watch the tutorial video.

#### For Microsoft Windows 7

- If Windows 7 can't recognize DFS100 unit, please download "[mchpcdc.inf](#)" from WhaleTeq's website. This driver is provided by Microchip®, and is intended to be used with PIC microprocessors which have built-in USB functions.



- When the USB module is connected for the first time, select Manual Installation, and point to the folder containing the above file. Then, continue to follow the instructions to finish the installation. There may be a warning that the driver is not recognized by Windows®, and this can be ignored. Please click [here](#) to watch the tutorial video.

#### 4.4 Microsoft .Net Framework Installation

WhaleTeq's software is developed based on Microsoft .Net Framework 4.0. If DFS software fails to execute properly, please check whether Microsoft .Net Framework 4.0 or a higher version was installed in the operating system.

If the PC hasn't installed Microsoft .Net Framework 4.0 or a higher version, please download it from Microsoft's website. Please click [here](#) to watch the tutorial video (from 2:03).

#### 4.5 PC Software and Firmware Auto-Update

User can download the latest software from WhaleTeq's website. If User cannot update the DFS software, please contact WhaleTeq's service team ([service@whaleteq.com](mailto:service@whaleteq.com)).

## 5 PC Software Operation

### 5.1 Software Function Introduction

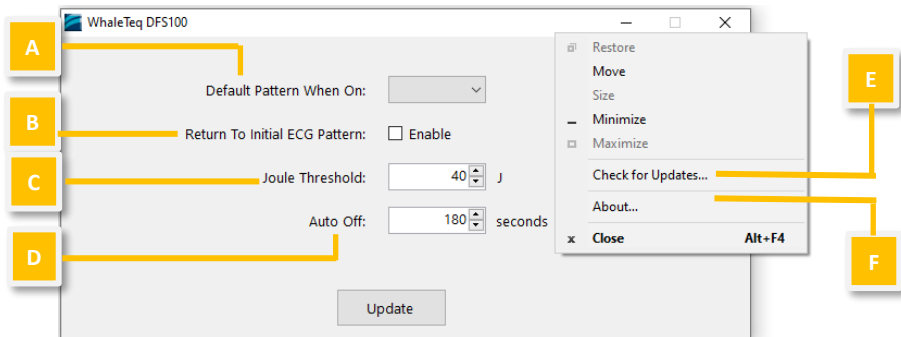


Figure 5: PC Operation Interface

The DFS100 PC Software is solely for customized settings. It does not include testing functions.

- A. Default Pattern When On:** User can choose from VT (Ventricular Tachycardia), VF (Ventricular Fibrillation), or NSR (Normal Sinus Rhythm) as the default playing pattern when turning on DFS100.
- B. Return To Initial ECG Pattern:** When using ONE-TIME TEST mode  $\leftrightarrow$ , User has the option to enable the “Auto Return to Initial ECG Pattern” function, which does so upon 30 seconds after receiving defibrillation.

**Note:**

If User doesn't enable the “Auto Return to Initial ECG Pattern” function, User will need to manually switch the pattern from NSR to VT or VF if needed for the next inspection.

- C. Joule Threshold:** Depending on different models of DUT (AED), the delivered defibrillation is different. DFS100 allows User to self-define the passing criteria of the defibrillation. If the joule of the defibrillation equals to or is higher than this value, the AED Discharge LED lights green; otherwise, lights red.

**Note:**

User can set the parameter from 40 to 360 Joules.

- D. Auto Off:** DFS100 will automatically be turned off after being idle for a certain time. The default value is 3 minutes.

**Note:**

User can set the time from 3 to 10 minutes.

- E. Check for Updates:** Click to see if the latest version of firmware and/or software has been released. Please note that the USB cable used for firmware upgrade must be file-transferrable.
- F. About:** Check the software version and the device function introductions.

## 6 Standalone Operation

### 6.1 One-Time Test (Convert)

In this mode, the test starts immediately upon DFS100 being turned on, and it simulates the ECG pattern of a resuscitated-needed patient.

Ensure the AED and DFS100 are connected properly via the interface cable. Turn on both DFS100 and the AED, and follow the AED instructions. The default setting of DFS100 is sending VT to the AED. After the AED delivers defibrillation shock, DFS100 shows the pass/fail of the defibrillation energy by lighting different LED colors for 30 seconds.

**Note:**

If the test passes, the LED lights green. If the test fails, the LED lights red.

At the same time, DFS100 simulates the patient having been resuscitated by changing the ECG pattern to NSR.

### 6.2 Continuous Arrhythmia Test

In this mode, DFS100 continuously sends user-selected arrhythmia to the AED.

Ensure the AED and DFS100 are connected properly via the interface cable. Turn on both DFS100 and the AED, and follow the AED instructions. The default setting of DFS100 is sending VT to the AED. After the AED delivers defibrillation shock, DFS100 shows the pass/fail of the defibrillation energy by lighting different LED colors for 30 seconds.

**Note:**

If the test passes, the LED lights green. If the test fails, the LED lights red.

Then, User may connect DFS100 to the other AED for the next test. The test starts without User pressing any button on DFS100.

## 7 Calibration and Validation

It is recommended to get DFS100 calibrated annually. Calibration and validation both require traceable equipment. Steps for Calibration/ Validation methods are available upon request. Please contact Whaleteq for more details (See section 13).

## 8 Troubleshooting

- (1) If after the AED defibrillation shock, and the DFS100 “Discharge” LED does not light up, check the AED interface cable connection.
- (2) If User is certain that the AED defibrillation energy matches its spec, but the “Discharge” LED lights red, check the PC software setting (section 5.1 **(C)**) to ensure the joule threshold is set correspondingly.
- (3) When DFS100 “Battery” LED blinks red, change the battery at User’s earliest convenience.

## 9 Cautions

- (1) Follow AED instructions during testing with DFS100.**
- (2) Follow the color code and / or labeling when connecting DFS100 and the AED via the AED interface cable.**
- (3) When DFS100 is in use, the face containing LEDs and buttons must face up to allow ventilation.**
- (4) To allow ventilation, DFS100 should be used to analyze defibrillation energy at the interval of at least 60 seconds.**
- (5) USB cable used for firmware upgrade must be file-transferrable.**
- (6) Battery, whether one-time use or rechargeable, must be included in DFS100 for accurate energy measurement.**
- (7) When Battery LED blinks red, the Discharge LED may dim and blink at a faster frequency. This is a warning to change the battery as soon as possible in order to ensure accurate test results.**
- (8) USB Port cannot be used to charge the battery.**
- (9) For best performance, rechargeable battery capacity is recommended to be 800 mAh or above.**

- (10) When not in use for a longer period, remove the battery from DFS100 to ensure a longer lifespan of the battery.
- (11) Clean the external case of the DFS100 with a clean dry cloth. Do not allow liquid inside DFS100 or near the I/O sockets.
- (12) If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## 10 Ordering Information

Table 7: DFS100 Test System

Order No.	Description
300-DFS100	DFS100 AED field tester main device
D06-9000321	9V alkaline battery
K22-0500101 *	Open-ended AED cable (Banana Male), 0.5 meter (Black)
K22-0500102 *	Open-ended AED cable (Banana Male), 0.5 meter (Red)
N61-0210033	Compact splicing connector

\* Customization of AED interface cable adapter is available. Please contact WhaleTeq ([service@whaleteq.com](mailto:service@whaleteq.com))

Table 8: Optional Accessories

Order No.	Description
K27-1800304	USB transfer cable A to C (M to M), 1.8 meter
G34-0600101	DFS carrying bag

Table 9: Optional Calibration Service and Warranty Extension

Model No.	Description
C3	Provides (3) years of calibration service coverage. WhaleTeq equipment can be calibrated to original performance on the basis of (1) year interval.
R3	Extend the limited warranty from (1) year to (3) years.

## 11 Package Contents

Table 10: DFS100 Standard Package Content

Item	Q'ty
DFS100 AED field tester main device	1
9V alkaline battery	1
Open-ended AED cable (Banana Male), 0.5 meter (Black)	1
Open-ended AED cable (Banana Male), 0.5 meter (Red)	1
Compact splicing connector	2

### DFS100 Optional Accessories

- ✓ USB transfer cable A to C (M to M)
- ✓ DFS carrying bag

## 12 Revision History

Table 11: User Manual Revision History

Version	Revision Description	Issue Date
2021-08-03	First Version	2021-08-13

## 13 Contact WhaleTeq

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