

**W&S** waveSurfer™ Accessory

## **LeCroy WS-DCADAP**

# **EXTERNAL DC ADAPTER User's Manual**



**LeCroy**

WaveSurfer is a trademark of LeCroy Corporation.

Windows is a registered trademark or a trademark of Microsoft Corporation in the United States and other countries.

## Foreword

- ◇ Thank you for purchasing LeCroy's EXTERNAL DC ADAPTER.
- ◇ Before using this instrument, please read this manual thoroughly to gain a good understanding of it. After reading, please keep the manual in a safe place.
- ◇ This manual describes notes on use and basic usage of the EXTERNAL DC ADAPTER.

## Notes

- ◇ Parts of the contents of this manual may be modified without prior notice for improvements in performance and functions.
- ◇ Reproduction or reprinting of the contents of this manual without prior permission from LeCroy is prohibited.
- ◇ If you have questions about this instrument, please contact LeCroy Corporation. (Refer to the contact address given at the end of this manual.)

### Revision History

- ◇ June 2005: 1st edition

## Checking the Packing Content

On delivery of the instrument, check each item. If any of the items are missing or there is any damage, immediately contact LeCroy or the sales office in charge.

[Items to be present]

- DC Adapter (EXTERNAL DC ADAPTER) ..... 1

Accessories

- WS-DCADAP cable ..... 1
- Safety Ground cable ..... 1
- User's manual ..... 1

## Sending Back for Repairs

If the instrument is inoperable, send it back to LeCroy Corporation. (Refer to the contact address given at the end of this manual.) We will repair it without charge as long as it is under warranty.

When sending back the instrument, explicitly describe the following: product name, serial number, description of the trouble, name/post/phone number of the contact person.

# Table of Contents

■ Safety Requirements .....	2
Safety Symbols & Terms .....	2
Operating Conditions .....	2
■ Product Disposal and Recycling .....	5
■ Overview .....	6
■ Configuration .....	6
■ Units and Devices.....	7
(a) DC Adapter .....	7
(b) WS-DCADAP Cable.....	8
■ Operating Procedures .....	9
(a) Mounting the DC Adapter on the Oscilloscope .....	9
(b) Connecting the DC Power Cord to the Oscilloscope .....	10
(c) Connecting the WS-DCADAP Cable.....	11
(d) Connecting the WS-DCADAP Cable to the Battery .....	13
(e) Starting Up the Oscilloscope.....	14
(f) Turning Off the Oscilloscope.....	16
(g) Turning Off the DC Adapter and the Battery .....	16
■ Indicators.....	17
■ Protective Functions .....	18
■ Specifications .....	20
(a) Product Specifications - Electrical.....	20
(b) Product Specifications - Mechanical.....	21
(c) Certifications .....	21

## ■ Safety Requirements

This section contains information and warnings that must be observed to keep the DC Adapter operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the safety precautions specified in this section.

### Safety Symbols & Terms

The following safety symbols & terms may appear on the product and they alert you to important safety considerations.



This symbol is used where caution is required. Refer to the accompanying information or documents in order to protect against personal injury or damage to the instrument.



This symbol warns of a potential risk of shock hazard.

#### CAUTION

The CAUTION sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause damage to equipment. If a CAUTION is indicated, do not proceed until its conditions are fully understood and met.

#### WARNING

The WARNING sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause bodily injury or death. If a WARNING is indicated, do not proceed until its conditions are fully understood and met.

### Operating Conditions

Before using this product, ensure that its operating environment will be maintained within these parameters:

Temperature : 5 to 40 °C

Humidity : Maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C.

Altitude: Up to 2,000 m

The design of the DC Adapter has been verified to conform to the applicable safety standards (EN 61010-1:2001, UL 61010-1 2<sup>nd</sup> Edition and CAN/CSA C22.2 No.61010-1-04) per the following limits:

Installation (Overvoltage) Category I  
(All mains isolated terminals)

Pollution Degree 2

Protection Class I



### CAUTION

To avoid personal injury or damage to the WS-DCADAP or the WaveSurfer oscilloscope connected to it, review and comply with the following safety precautions.

- **Use only as intended.**  
The WS-DCADAP is intended to be used only with the LeCroy WaveSurfer series oscilloscopes to supply the DC drive power to the scope. Use of the WS-DCADAP and/or the scope it is connected to in a manner other than specified may impair the protection mechanisms.
- **Connect and disconnect properly.**  
Avoid damage to cables thru excessive bending.
- **Do not use in wet/damp or explosive atmospheres.**
- **For indoor use only.**  
The WS-DCADAP is intended for indoor use and should be operated in a clean, dry, environment.
- **Do not operate with suspected failures.**  
Do not use WS-DCADAP if any part is damaged. All maintenance should be referred to qualified service personnel.
- **Keep product surfaces clean and dry.**

- **Do not float the WaveSurfer oscilloscope when it is powered by DC Adapter. Use the safety ground cable to connect oscilloscope to earth ground.**

When operating the WaveSurfer oscilloscope from AC line power with the standard power cord the oscilloscope is connected to earth ground via the third-wire in the AC power cord. When operating the WaveSurfer oscilloscope with the WS-DCADAP, there is no connection to earth ground and the oscilloscope is floating.

Operating the oscilloscope in this manner causes accessible metal parts to be at the same potential of the probe ground leads. This results in a dangerous condition with the potential of elevated voltages present on the oscilloscope causing a shock hazard to the operator and also places stress on the power transformer insulation. Over time this stress may result in dangerous failures which create a shock and fire hazard even during properly grounded operation.

Without AC power and the standard AC power cord the WaveSurfer oscilloscope is not grounded and will be floating unless the included grounding cable is connected between the oscilloscope and earth ground. If the oscilloscope probes or channels are connected to circuits or devices that have voltages less than 30Vrms or 42Vpk from earth ground the ground cable is not required. For any circuits where voltages greater than 30Vrms or 42Vpk may be present the ground cable must be connected. If the operator is unsure if a higher voltage is present the ground cable should be used. Operating the oscilloscope in the presence of these voltages without properly grounding the instrument may result in electrical shock which can result in serious personal injury or loss of life.

It is also important to remember not to connect a grounded device such as a computer or printer to the oscilloscope while it is floating. To connect a grounded device to the WaveSurfer oscilloscope while using the WS-DCADAP the ground cable must be connected between the oscilloscope and earth ground.



**WARNING**

To avoid electric shock, always connect scope ground terminal to earth ground when WaveSurfer oscilloscope is powered by DC Adapter.

**CLEANING**

The outside of the WS-DCADAP hardware should be cleaned with a soft cloth dampened with either deionized / distilled water or isopropyl alcohol. Allow the surface to dry completely before returning the instrument to service.

**USE AND MAINTENANCE**

The WS-DCADAP is a high quality, precision instrument. To maintain accuracy, mechanical shock should be avoided, as well as damage to the cables through excessive bending. All maintenance and component replacement should be referred to qualified personnel.

## ■ Product Disposal and Recycling



This electronic product is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles.

For more information about proper disposal and recycling of your LeCroy product, please visit [www.lecroy.com/recycle](http://www.lecroy.com/recycle).

## ■ Overview

This adapter is an accessory device specially designed for the WaveSurfer 400 Series Oscilloscopes. The purpose of the adapter is to supply the DC drive power to the oscilloscope.

Normally the oscilloscope is used with the power cord connected to an AC power line. Mounting this adapter allows the WaveSurfer to operate with the voltage supplied from a 12 V automotive battery or other DC power source.

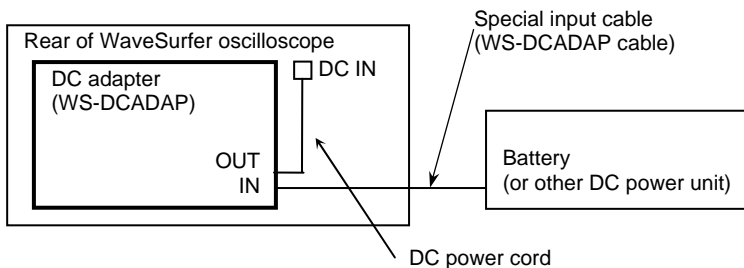
This instruction manual describes how to mount the adapter on the oscilloscope, how to connect the adapter to the battery and the oscilloscope, and how to operate the adapter.

Thoroughly read the contents of this instruction manual and understand its contents before using the accessory.

## ■ Configuration

This adapter is used with it mounted on the rear of the WaveSurfer oscilloscope as shown in Fig. 1. Connect the adapter to a battery using the special input cable (WS-DCADAP cable). The input voltage supplied from a battery is converted to 24 Vdc and output to the DC IN connector at the rear of the oscilloscope.

**NOTE** If commercial AC power is supplied through the AC power cord connected to the rear of the oscilloscope, the oscilloscope operates giving a higher priority to the AC power supply.

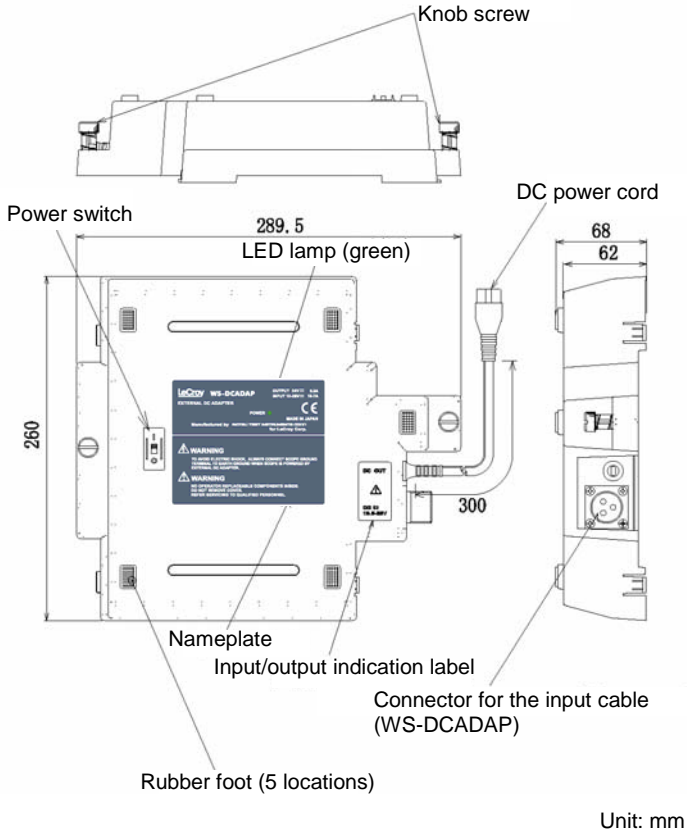


**Figure 1 DC-driven Configuration of the Oscilloscope (with the DC Adapter)**

## ■ Units and Devices

### (a) DC Adapter

Figure 2 shows the outside view of the adapter.

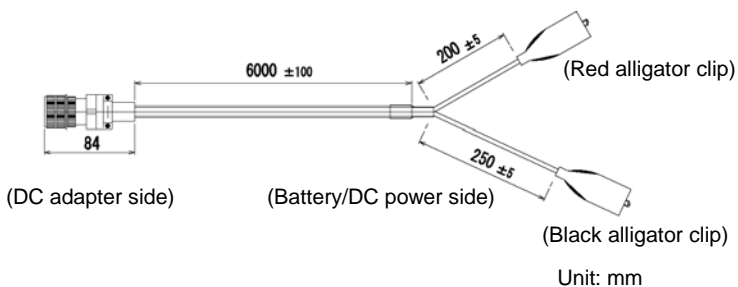


**Figure 2 Outside View of the DC Adapter**

### (b) WS-DCADAP Cable

This is an input cable specially designed for the DC adapter.

Figure 3 shows the outside view of the cable.



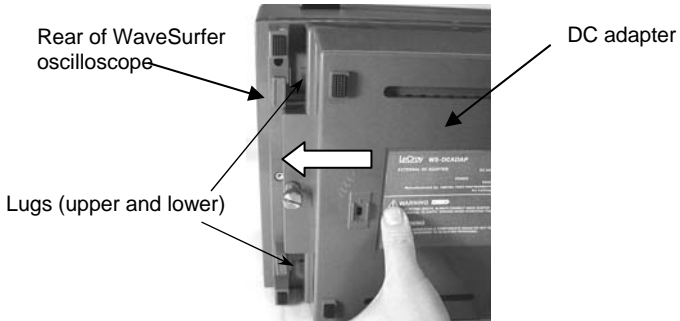
**Figure 3 Outside View of the WS-DCADAP Cable**

## ■ Operating Procedures

To use this product, follow the steps below.

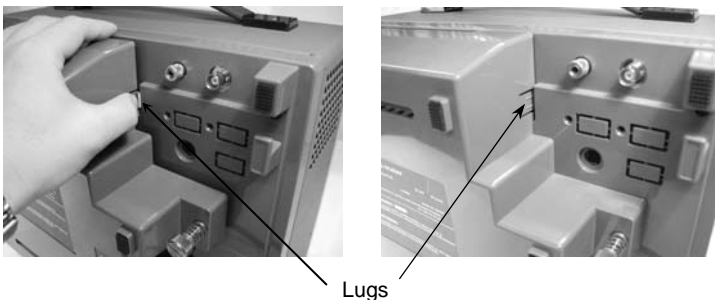
### (a) Mounting the DC Adapter on the Oscilloscope

1. Place the rear sides of the DC adapter and the WaveSurfer oscilloscope so that they face each other. Align the upper and lower lugs on the left side of the adapter (viewed from the rear side of the oscilloscope) with the lug holes, and then insert the lugs into the holes by sliding the adapter leftward.



**Figure 4 Mounting the DC Adapter A (Left Side)**

2. Then align the upper and lower lugs on the right side of the adapter (viewed from the rear side of the oscilloscope) with the lug holes and insert them into the holes. (See Figure 5 below.)



**Figure 5 Mounting the DC Adapter B (Right Side)**

3. Tighten the right and left screw knobs by hand while pressing them in to fasten the DC adapter to the oscilloscope. (See Figure 6 below.)

NOTE Tighten the right and left screw knobs evenly.

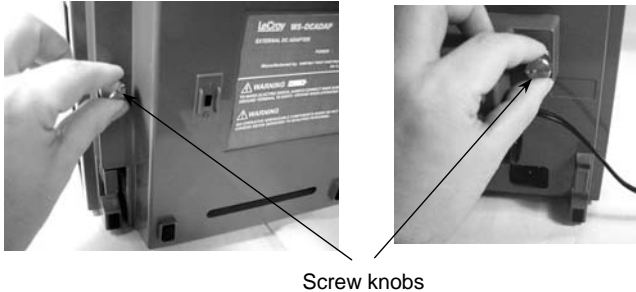


Figure 6 Fastening the DC Adapter

### (b) Connecting the DC Power Cord to the Oscilloscope

After mounting the DC adapter on the rear of the WaveSurfer oscilloscope, connect the DC power cord following the steps below.

1. Connect the DC power cord of the DC adapter to the DC IN at the upper right corner of the rear of the oscilloscope. (See Figure 7 below.)

NOTE Make sure to connect the cord to the DC IN correctly and to connect the plus and minus terminal in the correct direction .

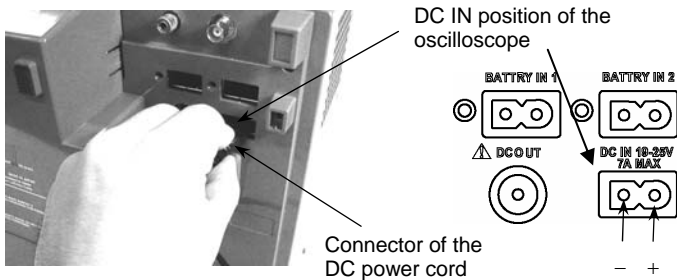


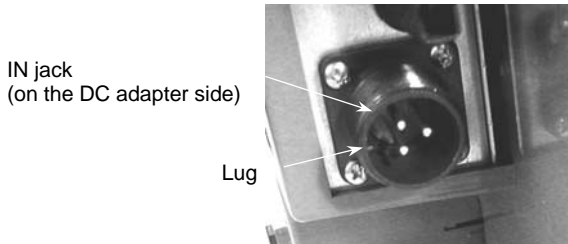
Figure 7 Connecting the DC Power Cord

### (c) Connecting the WS-DCADAP Cable

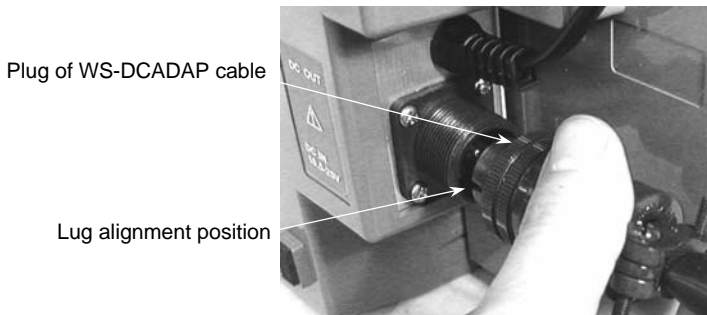
The WS-DCADAP cable is used to input the voltage supplied from the battery to the DC adapter.

1. Check the lug positions of the DC adapter IN jack and the WS-DCADAP cable plug. (See Figures 8a and 8b below.)

NOTE When fitting the connector, align the lug positions.



**Figure 8a** Checking the Lug Position (on the DC Adapter Side)



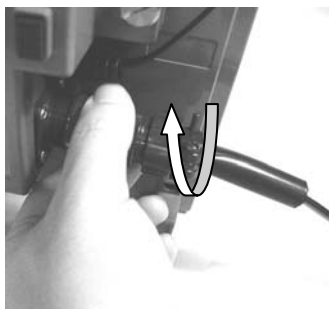
**Figure 8b** Checking the Lug Position (on the Input Cable Side)

2. Press the WS-DCADAP cable plug into the IN jack while aligning the lug positions. (See Figure 9 below.)



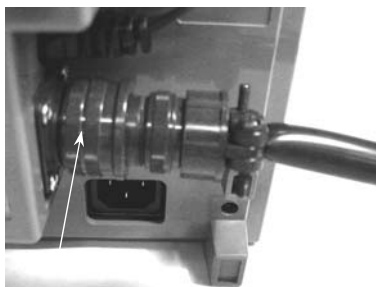
**Figure 9 Fit of the IN Section**

3. Tighten the setscrew of the WS-DCADAP cable plug around the jack screw of the DC adapter to fasten the connector. (See Figures 10a and 10b below.)



Rotate in the direction indicated by the arrow to tighten the setscrew.

**Figure 10a  
Fastening the Input Connector**



Setscrew  
(plug of WS-DCADAP cable)

**Figure 10b  
Connection of Input Section  
(Completed)**

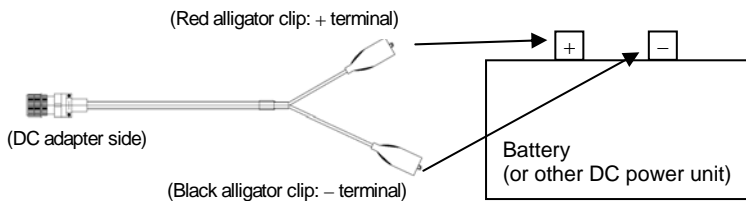


**(d) Connecting the WS-DCADAP Cable to the Battery**

NOTE 1 Make connections with the following combination:

- Red alligator clip: Positive terminal of the battery
- Black alligator clip: Negative terminal of the battery

NOTE 2 Before making connections, make sure to turn off the POWER switch of the DC adapter.



**Figure 11 Connecting the WS-DCADAP Cable to the Battery**

## (e) Starting Up the Oscilloscope

After making necessary connections, start up the oscilloscope following the steps below.

1. Set the input voltage to the DC adapter.

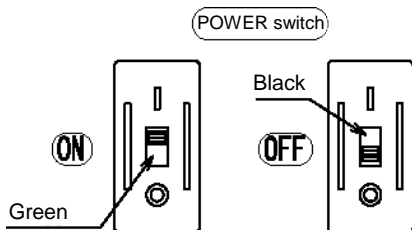
NOTE 1 Use a battery with the rated output voltage of 12 Vdc or 24 Vdc.

NOTE 2 Set the output voltage of the DC power unit in the range between 12 Vdc and 28 Vdc.

2. Connect to the battery or turn on the output switch of the DC power unit.

NOTE 3 The standby time until a voltage of 23.5 V is output after the DC power has been supplied is approximately 5 sec.

3. Turn on the POWER switch of the DC adapter. (See Figure 12 below.)



**Figure 12 POWER Switch**

Now the oscilloscope can operate with the voltage supplied from the battery (or other DC power unit) and the DC adapter.

NOTE 4 If a commercial AC power is supplied through the AC power cord connected to the rear of the oscilloscope, the oscilloscope operates giving a higher priority to the AC power supply.

When both the AC power and DC power are connected, the AC power is used as drive power. However, if the AC power is interrupted, the power is automatically switched to the DC power. Additionally, if the AC power is connected while the DC power is being used,

the power is automatically switched to the AC power. In such cases, a switching time of approximately 1 sec is required to switch the power inside the oscilloscope. If the AC power is connected while the DC power is being used and the DC power is turned OFF (or the cable is disconnected) at the same time, the power supply is interrupted during switching time and the oscilloscope operation is completed abnormally, causing the oscilloscope to be faulty or data to be corrupted.

4. Turn on the ON/STANDBY switch provided at the lower left on the front panel of the WaveSurfer oscilloscope.

The oscilloscope will start operating.

**NOTE 5** When the DC adapter is used together with a vehicle-installed battery, do not start the engine while the WaveSurfer is operating. Failure to observe this may result in a breakdown in the WaveSurfer or corruption of data. When the engine is started (while a cell motor is used), the power to the WaveSurfer may be shut down due to a temporary drop of the battery voltage.

**NOTE 6** When the DC adapter is used together with a vehicle-installed battery, be careful with the charge status of the battery. If you keep the WaveSurfer in operation for a long time while the vehicle engine is stopped, the battery power will be consumed and you may not start the engine or the battery may deteriorate.

### **(f) Turning Off the Oscilloscope**

Follow the instructions in the WaveSurfer Operator's Manual to turn off the oscilloscope

### **(g) Turning Off the DC Adapter and the Battery**

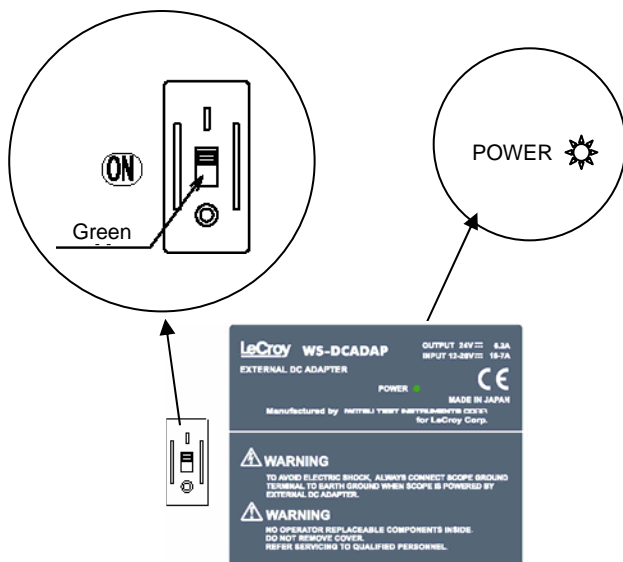
After the power supply of the oscilloscope has entered the standby state, perform the terminating operation as shown below.

1. Turn off the POWER switch of the DC adapter.
2. Disconnect the cable from the battery or turn off the output switch of the DC power unit.

**NOTE7** While the oscilloscope is in STANDBY or the POWER switch of the DC adapter is off, power consumption in the STANDBY state is at a minimal, but non-zero, level.

## ■ Indicators

If you turn on the POWER switch of the DC adapter, the (green) POWER lamp in the label goes on.



**Figure 13** Status Indication of the DC Adapter

## ■ Protective Functions

This adapter is equipped with several protective functions for electrical specifications, temperature, etc. Table 5 shows those functions and related phenomena.

If any phenomenon in Table 5 is observed, please contact LeCroy Corporation. (Refer to the contact address given at the end of this manual.)

**Table 5 Description of Protective Functions (1 of 2)**

<Protective Function>	Description & Phenomenon
Output overvoltage protection	If the output voltage has risen too high, an error (overvoltage) is detected and the output will stop. It is necessary to resolve the overvoltage state. Please contact LeCroy Corporation.
Output short circuit protection	Do not cause a short on the output side. For restoration, resolve the short circuit while keeping the POWER switch in an OFF state. Then turn on the POWER switch.
Output overcurrent protection	If the output current has risen too high, the output will stop. It is necessary to resolve the overcurrent state. Please contact LeCroy Corporation.
Overheat protection	If the inside of the DC adapter becomes too hot because the fan motor stopped or the adapter was used in a very hot environment, the output stops to protect the adapter from damage. It is necessary to determine the cause of temperature rise and resolve it. Please contact LeCroy Corporation.

**Table 5 Description of Protective Functions (2 of 2)**

<Protective Function>	Description & Phenomenon
Protection against low-voltage lockout and high-voltage	<p>If the input voltage to the DC adapter drops below about 8 V, the output will stop.</p> <p>Also if the input voltage to the DC adapter rises above about 30 V, the output will stop.</p> <p><b>If a voltage exceeding the rated value is input, some devices may not be restored. Never apply a voltage exceeding the rated value.</b></p> <p>If a high voltage was applied by mistake, please contact LeCroy Corporation.</p>

NOTE1 If the input voltage to the DC adapter is interrupted instantaneously or if it exceeds the specified power supply range, the output may be stopped to protect the oscilloscope. If the POWER lamp is not lit with the POWER switch ON, turn OFF the POWER switch once, and then perform the reset operation to turn ON the power again.

NOTE2 When the DC OUT cable is connected to the oscilloscope with the POWER switch of the DC adapter ON, the protective function may be activated, resulting in no output. If this occurs, turn OFF the POWER switch once, and then perform the reset operation to turn ON the power again.

## ■ Specifications

### (a) Product Specifications - Electrical

Item	Specifications	
Input voltage range	12 to 28 Vdc (at the end of the alligator clip)	
Input current	Max 18 A (for the input voltage of 12 V)	
Input power	Rated power: About 150 W Max: About 200 W	
Output voltage	23.5 Vdc $\pm$ 5%	
Output current	Rated current: 5.0 A, Max current: 6.3 A	
Power consumption in stand-by mode	POWER switch is off	Max 1.2VA (for 12 V) * <sub>2</sub> Max 2.1VA (for 24 V) * <sub>2</sub>
	POWER switch is on	Max 3.6 VA (for 12 V) * <sub>3</sub> Max 5.0 VA (for 24 V) * <sub>3</sub>
Insulation resistance	50M $\Omega$ or greater (for 250 Vdc)	
Dielectric strength	250 Vdc	
Temperature	During operation: +5 °C to +40 °C (DC adapter) +5 °C to +100 °C (cable) During storage (non-operation): -20 °C to +60 °C	
Humidity (non-condensing)	During operation: Maximum relative humidity (RH) 80 % for temperatures up to 31 °C decreasing linearly to 50 % RH at 40 °C. During storage (non-operation): 5% to 95% RH. Upper limit derates to 50% RH above 40 °C.	
Altitude	During operation: Up to 6,562ft (2,000m) During storage (non-operation): Up to 40,000ft (12,192m)	

\*1. The appearance and specifications are subject to change without prior notice.

\*2. The value is only for DC adapter.

\*3. The value includes both the oscilloscope and DC adapter power consumptions in standby mode.



**(b) Product Specifications - Mechanical**

Outside dimensions	W: 289.5×H: 62.0×L: 260.0 mm
	Tolerance: 2 mm
Length of WS-DCADAP cable	6000mm ±100 mm
Length of DC power cord	300 mm ±20 mm
<b>Safety Ground cable</b>	<b>2000 mm ±20 mm</b>
Weight	<b>Total weight: About 2.5 kg</b> DC adapter: About 1.5 kg WS-DCADAP cable: About 0.9 kg <b>Safety Ground cable: About 0.1 kg</b>

**(c) Certifications**

EC Declaration of Conformity	Meets intent of the European Council Directives 73/23/EEC for product safety and 89/336/EEC for electromagnetic compatibility. This declaration is based upon compliance of the WS-DCADAP to the following standards:
	EN 61326: 1997 +A3:2003 EMC requirements for electrical equipment for measurement, control, and laboratory use. EN 55022: 1994+A1:1995+A2:1997 Radiated Emissions (Class A)
	EN 61000-4-2:1999 Electrostatic discharge (±4kV contact discharge; ±8kV air discharge)
	EN 61000-4-3: 2002+A1:2003 RF Radiated Fields (3V/m, 80 MHz to 1 GHz, 80% amplitude modulated)
	EN 61010-1: 2001 Safety requirements for electrical equipment for measurement control and laboratory use

**UL and cUL Listed** - Conforms to UL 61010-1 , 2<sup>nd</sup> Edition and CAN/CSA C22.2 No. 61010-1-04 as a listed accessory to WaveSurfer Oscilloscope.

LeCroy Corporation  
700 Chestnut Ridge Road  
Chestnut Ridge, NY 10977-6499  
Tel: (845) 578 6020, Fax: (845) 578 5985  
Internet: [www.lecroy.com](http://www.lecroy.com)

© 2004 by LeCroy Corporation. All rights reserved.

LeCroy, ActiveDSO, ProBus, JitterTrack, WavePro, WaveMaster,  
WaveSurfer, and Waverunner  
are registered trademarks of LeCroy Corporation. Information in this  
publication supersedes all earlier versions. Specifications subject to change  
without notice.

