



Digidata[®] 1550B

Low-Noise Data Acquisition System plus HumSilencer™
Adaptive Noise Cancellation

User Guide

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Safety Information

This section provides information on the use of precautions to follow before operating the Digidata 1550B digitizer, the location of safety labels on the instrument, and a key to understanding safety label icons.



WARNING! If the Digidata 1550B digitizer is used in a manner not specified by Molecular Devices, the protection provided by the equipment may be impaired.



WARNING! The Digidata 1550B digitizer is an Equipment Class 1 product that relies on protective earth grounding for safe operation. Any interruption of the protective earth ground conductor, inside or outside the instrument, or disconnection of the protective earth ground terminal, may result in personal injury.







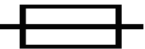


WARNING! Do not position the equipment so that it is difficult to disconnect the device.

Instrument Safety Labels

Safety labels are located on the instrument. Each Safety label consists of:

- Signal Word panel, which implies a particular level of observation or action (for example, CAUTION or WARNING). If a safety label encompasses multiple hazards, the Signal Word corresponding to the greatest hazard is used.
- Message panel, which explains the hazard and any user action required.
- Safety Alert symbol, which indicates the type of potential personal safety hazard.

Symbol	Indication
	Indicates that product documentation needs to be consulted
	Indicates Alternating Current
	Indicates power on
	Indicates power off
	Indicates the location of the Protective Earth Ground Terminal
	Indicates that you must not discard this electrical/electronic product in domestic household waste
	Indicates fuse

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Introduction

1

The Digidata® 1550B is a high-resolution, low-noise digitizer intended for precision scientific applications. It is particularly designed for electrophysiology experiments, to send and receive signals from microelectrode amplifiers, and to interact with peripheral instruments such as solution changers and stimulators.

The Digidata 1550B digitizer has eight independent analog input channels at up to 500 kHz each, and has eight independent 16-bit analog outputs for arbitrary waveform generation. There are eight digital output lines, as well as a dedicated SCOPE digital output and TAG and START digital inputs. There are three models of the Digidata 1550B digitizer, one of which excludes the HumSilencer Adaptive Noise Cancellation System. The other two models of the Digidata 1550B digitizer with adaptive noise cancellation (ANC) provide configuration through Analog Input Channels #0, or Analog Input Channels #0, #2, #4 and #6 to eliminate 50 Hz or 60 Hz line-frequency noise and associated high-frequency harmonics.

The Digidata 1550B digitizer communicates with the host computer using USB 2.0.

The Digidata 1550B digitizer is a plug-and-play device, so it is automatically recognized by Windows. The Digidata 1550B digitizer is supported on Windows systems by AxoScope Software Version 10.6 (or later) and by pCLAMP Clampex Software Version 10.6. AxoScope Software is an easy-to-use, full-featured data acquisition program for Windows that is included with the Digidata 1550B digitizer.

The Digidata 1550B digitizer is contained within a rack-mount case, but it also has non-marking elastomeric feet for use on a desktop.

Components

- Digidata 1550B digitizer
- Power cord
- USB 2.0 cable
- CD-ROM with AxoScope Software Version 10.6 for Windows
- Printed Quick Start Guide

Minimum Computer Requirements

- PC with a 2 GHz CPU
- Windows XP
- 2 GB RAM available
- 500 MB hard disk
- 800 × 600 display system (small fonts)
- One USB 2 port to use Axoscope Software (Two USB ports are required to use pCLAMP Software)

Recommended Computer System

- PC with a 2 GHz CPU (or faster)
- Windows 7 (32-bit or 64-bit)
- 4 GB RAM (or more)
- 2 GB hard disk (or more)
- 1680 x 1050 (or higher) display system (large or small fonts)
- 3 USB 2 ports

Programming

The Digidata 1550B digitizer is supplied with the AxoScope Software Version 10.6 turnkey software for continuous data acquisition. No programming is required for use with this program, or with the pCLAMP Software Version 10.6 data acquisition software.

For third-party programming of the digitizer, see the Test Bed and File Support Pack files included in the pCLAMP Software, or check the Molecular Devices website Service Knowledge Base for downloads.

HumSilencer Adaptive Noise Cancellation Theory of Operation

The HumSilencer Adaptive Noise Cancellation (ANC) system uses a combination of analog signal-processing circuitry and high-speed computing hardware to learn and subtract out unwanted electronic noise caused by the power line. Software controls in Clampex Software and AxoScope Software provide both the ability to turn on or turn off the electronic noise-learning, and the ability to report the whole signal or the signal-minus-noise. The ability to turn on or off the noise learning is provided so the scientist can control when noise is learned by the system to avoid learning a signal as noise.

Learning the pattern of line-caused noise starts with the understanding that the unwanted electronic noise is caused by the power line. The power line-frequency occurs with a period set by the local electrical grid. The grid produces alternating current (AC), with periods very close to the inverse of 50 Hz or 60 Hz. This AC line-voltage is sampled by circuitry inside the Digidata 1550B digitizer. The start of every line power-cycle is reported to the high-speed logic section of the processor. Using this timing signal as an input to mark the beginning and end of the power line-cycle, the digitization circuitry inside the Digidata 1550B digitizer averages the non-DC signal input to the ANC-enabled channels over 50 cycles. Due to the timing input, this is very selective for line-synchronous noise. Conversely, any input that is asynchronous with the power grid is excluded. A rolling average sets the time scale with which ANC adapts to noise changes, which means that the input of the newest power-cycle data causes the oldest data input to age out of the rolling average. To produce the noise-canceled signal, the average of the power-line noise in the signal is subtracted from the analog signal.

Notes on HumSilencer System Software Controls

An experienced scientist knows that noise cancellation, like any electronic computing system, depends on the correct inputs for the correct function. The noise cancellation system assumes that the electronic signal input to the adapting cancelling channel is noise, and removes it from the signal when the **Subtract** control is turned on. Manual control of the settings is provided to allow the adapting period to be correctly defined for specific experiments.

In the software, selecting the **Acquire > Edit Protocol > Inputs > HumSilencer** dialog tab check box, activates the ANC circuitry, activates the HumSilencer controls in the Real Time Controls panel, and starts learning the AC-line noise.

During a recording, in non-episodic stimulation modes, deselecting or selecting the **Adapt** check box controls when the noise-pattern learning is active. Also during a recording, deselecting or selecting the **Subtract** check box controls whether noise canceling is active.

The HumSilencer system is designed to adapt quickly to changes in noise. In a country with a 60 Hz electrical grid, the response time is about 5/6th of a second to adapt to changes in the line noise. In a country with a 50 Hz electrical grid, the response time is about 1 second. However large fast transients are problematic as a result of this ability to adapt quickly to changes in noise. Any fast transient in the signal at the same time that the line-noise is learned contaminates the noise average at 1/50 amplitude. This transient situation is not an issue if the peak-to-peak broadband noise associated with the signal is greater than about 1/25 of the amplitude of a step or spike in the signal. If the transient step or spike

is larger, it is displayed as an inverted miniature event in the noise-cancelled signal every 16.7 ms or 20 ms. To avoid this situation, deselect the **Adapt** check box at least one second before recording fast biological signals that have a signal-to-noise ratio greater than about 25.

For more detailed usage procedures, and to understand how controls for Episodic stimulation mode and Gap-free data acquisition mode differ, refer to the *pCLAMP™ 10 Electrophysiology Data Acquisition and Analysis Software User Guide Revision E*.

The following procedures install the new software and drivers parallel to previously installed hardware and software, allowing you to continue to use the earlier Digidata® 1440A or 1550 Series digitizers and earlier versions of the AxoScope Software or the pCLAMP Software suite. However, if you no longer use older installed digitizers and corresponding software, uninstall them before you begin the following new installation procedure. AxoScope Software Version 10.6 and pCLAMP Software Version 10.6, only support the Digidata 1440A digitizer and newer.

Installation involves procedures in the following order:

1. [Uninstalling Software](#)
2. [Installing AxoScope Software or pCLAMP Software Version 10.6 on page 12](#)
3. [Installing the pCLAMP Software Security Key on page 12](#)
4. [Installing the Digidata 1550B Digitizer on page 12](#)
5. [Configuring Software for Digidata 1550B Digitizer Use on page 13](#)

Uninstalling Software

This procedure works similarly for all previously installed AxoScope Software and pCLAMP Software. The file locations are similar, but the **AxoScope** or **pCLAMP** folders are identified by a different version number.

To uninstall the software:

1. Go to Windows **Start > All Programs > Molecular Devices (or Axon Laboratory)**.
2. Open the folder for the software version to be uninstalled, such as **pCLAMP 10.5**.
3. Select the version-appropriate **Uninstall** file, such as **Uninstall pCLAMP 10.5 Software**.
4. Follow the procedures on-screen to finish uninstalling the software.

Installing AxoScope Software or pCLAMP Software Version 10.6



Note: Before installing the software from a CD-ROM, verify on the Molecular Devices support web site it contains the latest version. If you do not have the latest version, you can download it from the support web site www.moleculardevices.com/support.html.

Install the AxoScope Software Version 10.6 or pCLAMP Software Version 10.6, which includes the Digidata 1550B digitizer drivers. An AxoScope Software Version 10.6 CD is included. If you have purchased the pCLAMP Software Version 10.6 suite, install it instead of AxoScope Software Version 10.6.

1. Insert the AxoScope Software Version 10.6 or pCLAMP Software Version 10.6 CD into your computer CD-ROM drive.
2. The setup dialog is displayed automatically; if not, use Windows Explorer to open the CD directory and double-click the **AxoScope_10_6_0_x.exe**, or **pCLAMP_10_6_0_x.exe** file. The installation menu appears.
3. Follow the on-screen instruction to install the software.

Installing the pCLAMP Software Security Key

If you install the optional pCLAMP Software Version 10.6, insert the provided pCLAMP 10 security key (dongle) into any USB port on your computer. The dongle must be connected to a USB port on your computer for pCLAMP 10 Electrophysiology Data Acquisition and Analysis Software (Clampex Software) use. Dongles for any previous versions of the pCLAMP Software are invalid.

Installing the Digidata 1550B Digitizer



CAUTION! After the unit is powered on, the first time it is initialized by the pCLAMP Software, the analog output channels send out a brief negative spike (~-10 V/25 ms and -5 V/270 ms). Make sure that the analog outputs are not connected to any equipment that can be damaged by such voltages during the startup period.

To install the Digidata 1550B digitizer:

1. Connect the power cord to the wall, and then to the Digidata 1550B digitizer rear panel **AC POWER** input connector.
2. Attach the USB 2 cable to a **USB 2** or **USB 3** port on your computer, and then to the digitizer.
3. Switch on the power on the Digidata 1550B digitizer.

The green **POWER** light is continuously on only when the digitizer is powered on and the USB cable is connected to a running computer.

Windows automatically finds the new hardware, and installs the drivers.

4. Configure AxoScope Software Version 10.6 or pCLAMP Software Version 10.6 for use with the digitizer.
5. Let the Digidata 1550B digitizer warm up for one hour before performing experiments.

Configuring Software for Digidata 1550B Digitizer Use

This configuration procedure applies to AxoScope Software Version 10.6 and Clampex Software Version 10.6. By default **Digitizer > Demo** mode is active.

To configure the software for use with the Digidata 1550B digitizer:

1. Run AxoScope Software or Clampex Software by double-clicking on the icon on the Windows desktop.
2. Click **Configure > Digitizer** to open the **Digitizer** dialog, then click **Change** (Figure 2-1).

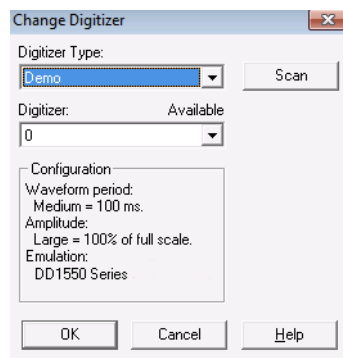


Figure 2-1: Example Digitizer Dialog

3. In the **Change Digitizer** dialog select **Digidata 1550B Series** from the **Digitizer Type** list (Figure 2-2 on page 14).

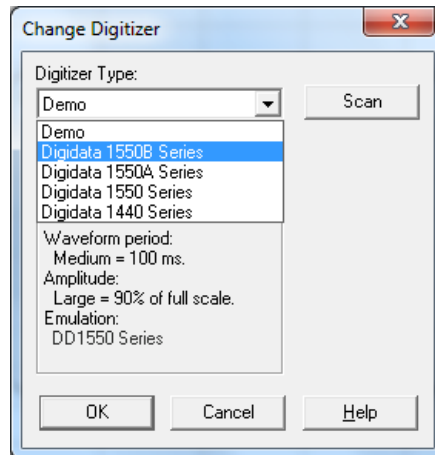


Figure 2-2: Digitizer Type Selection of Digidata 1550B digitizer

4. Click the **Scan** button to detect the digitizer. The first detected digitizer is assigned **0** and listed as **Available**. The **Configuration** information changes from **Not present** to reporting the selected digitizer model number, serial number, firmware version, HumSilencer channel availability (0, 1, or 4 = number available for use), and the **OK** button is enabled (Figure 2-3).

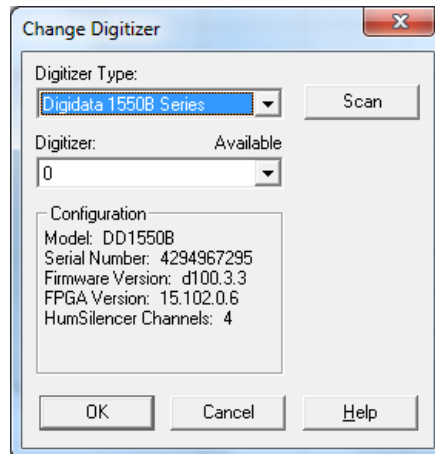


Figure 2-3: Configuration message changes after clicking Scan

5. Click **OK** to exit the **Change Digitizer** dialog (Figure 2-4 on page 15).

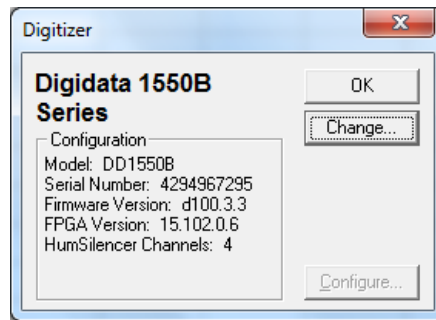
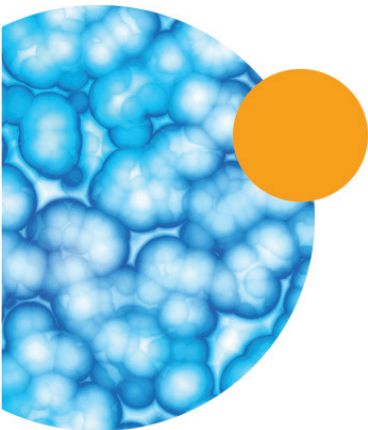
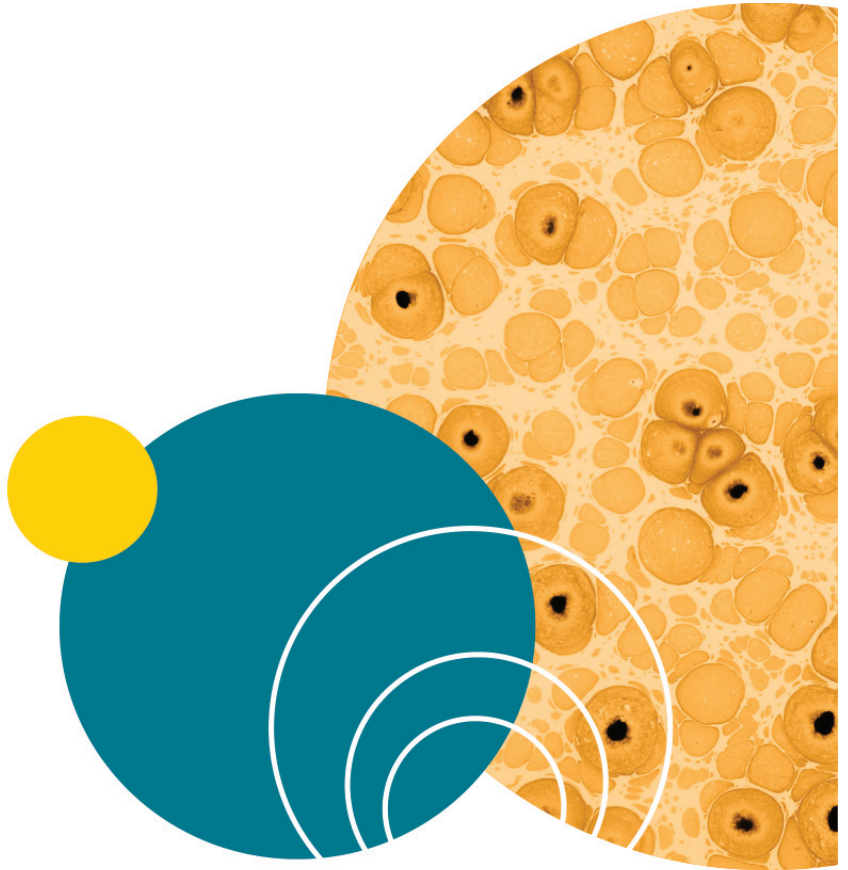


Figure 2-4: Digitizer dialog displaying active configuration

Updating the digitizer information can take up to one minute, after which, the **Digitizer** dialog shows the currently active digitizer configuration details.

6. Click **OK** to exit the **Digitizer** dialog.

The front panel yellow **READY** light is continuously on only when the software connects to the digitizer. After the Digidata 1550B digitizer warms up (allow one hour), it is ready to perform experiments.



Interface Description

Front Panel

The following is the front panel description of the Digidata 1550B digitizer.



Figure 3-1: Front panel of the Digidata 1550B digitizer.

There is a single rocker-style **On/Off** switch.

There are two indicator lights: **POWER** and **READY**.

- When the digitizer is powered on, and the USB cable is connected to the computer, the green **POWER** light is continuously on.
- When the digitizer is recognized by the software and ready for use, the yellow **READY** light is continuously on.

The front panel connectors are all BNCs.

Analog Inputs

There are eight 16-bit single-ended analog input channels. The BNC shields for the Analog Inputs are connected to the Analog ground. All of these channels can be used simultaneously without any reduction in throughput for each channel. These input channels are typically used to digitize biological signals. Depending on the Digidata 1550B digitizer model, when the HumSilencer™ adaptive noise cancellation system is available, Analog Input Channels #0, or Analog Input Channels #0, #2, #4 and #6 are configurable for eliminating ground signal noise.

Analog Outputs

The front panel has eight 16-bit analog output channels. Each channel has an operational amplifier to buffer the output signal of the D/A

converter. The eight analog output channels can be simultaneously used for waveform generation.

HumSilencer Adaptive Noise Cancellation

The HumSilencer adaptive noise cancellation system (ANC) is integrated into Analog Input Channels #0, #2, #4, and #6 of the Digidata 1550B digitizer, depending on the model, so no additional hardware installation is required. When it is in use, it eliminates electrical hum interference at 50 Hz or 60 Hz and the associated high-frequency harmonics. The ON/OFF switch for ANC is software-controlled. ANC works by learning the noise-patterns that are synchronous with the AC power, known as hum, caching a signal-averaged replica of the hum, and subtracting the noise replica from the signal in real time. It adapts to noise changes in about 1 second, within 50 power-cycles at 50 Hz or 60 Hz. It is designed to work with peak-to-peak hum amplitudes that, when combined with the signal of interest and other non-line-synchronous noise sources, are within the -10 to +10V range of the Digidata 1550B digitizer analog inputs. It is not a filter and does not have a filtering effect on acquired signals; nor does it cause waveform distortion, such as, frequency change, amplitude attenuation, phase shift, or DC-voltage shift.



Note: The HumSilencer system controls do not display in the AxoScope Software or the Clampex Software Demo configuration, nor do they display without a connection to and configuration with a Digidata 1550B digitizer that has an installed HumSilencer module.

The HumSilencer system control-enabling check box is part of the AxoScope Software Version 10.6 and the Clampex Software Version 10.6, located in the **Edit Protocol > Inputs** dialog tab (Figure 3-2). A blank check box indicates that the Real Time Controls panel items for ANC are disabled. The HumSilencer check boxes correspond to the type of ANC channels module with which your instrument is equipped (0, 1, or 4).

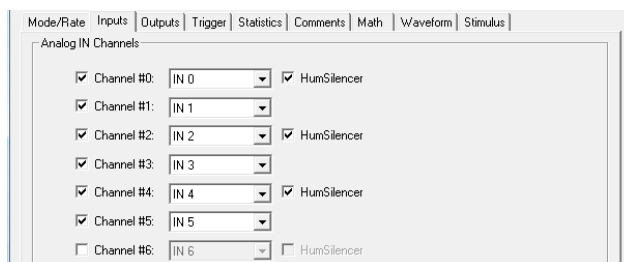


Figure 3-2: Edit Protocol > Input dialog tab check boxes used to enable the Real Time Controls panel items for the HumSilencer system.

When AxoScope Software or Clampex Software starts, **HumSilencer > Adapt** check box on the Real Time Controls panel is automatically enabled and learning the line-frequency noise (Figure 3-3).



CAUTION! The Real Time Controls panel items under **HumSilencer** do nothing if an enabling **Edit Protocol > Inputs > HumSilencer** dialog tab check box is not selected for an available **Analog IN Channel** (Figure 3-2 on page 18).

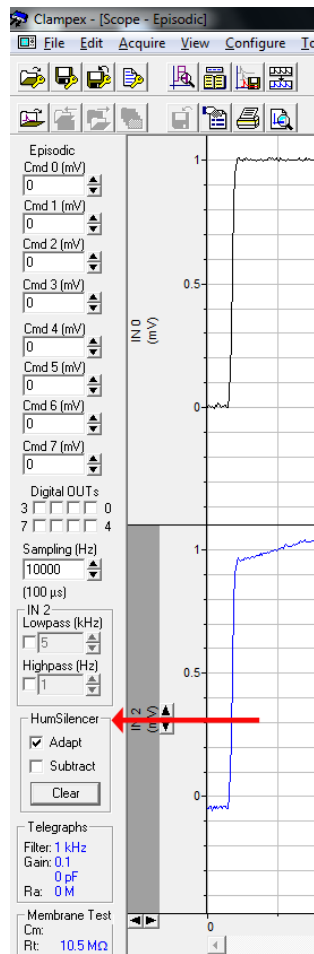


Figure 3-3: The HumSilencer system Real Time Controls panel items in active learning mode, but not actively canceling noise.



Figure 3-4: The HumSilencer system Real Time Controls panel items in active learning mode and actively canceling noise.

The Real Time Controls panel items for the HumSilencer system include (Figure 3-4):

- **Adapt** — Select this check box to turn on real-time noise pattern learning.
To turn off the real-time noise pattern learning, deselect the **Adapt** check box.



Note: The **Episodic stimulation** mode in Clampex Software automatically deselects **Adapt**.

Deselect **Adapt** when you have big steps or spikes in your signal, because fast changes will be visible at as an excursion scaled to -1/50 of the fast signal amplitude in the output and will take 50 power cycles (about 1 second) to age out of the rolling averaged noise replica.

Also deselect **Adapt** when you have line-synchronous signal components that are of interest.

- **Subtract** — Select this check box to turn on adaptive noise cancelation.
To turn off adaptive noise cancelation, deselect the **Subtract** check box.
- **Clear** — Click this button to reset the collected cache of the learned real-time noise-patterns. **HumSilencer Start** and **HumSilencer Stop** comment tags are displayed in the Clampex Software or AxoScope Software data file.

For more detailed usage procedures, refer to the *pCLAMP™ 10 Electrophysiology Data Acquisition and Analysis Software User Guide Revision E*.

Digital Outputs

Digital Outputs 0–7 are on the front panel of the Digidata 1550B digitizer. These output levels can be set to high (+5 V) or low (0 V) TTL-level compatible states. They can be used to trigger a wide variety of external devices.

Start and Tag Input Triggers

START and TAG are digital input triggers compatible with TTL-level signals.

- The START input is used to begin data acquisition from an external trigger source.
- The TAG input is used to automatically mark events (for example, perfusion ON) within the data.

Scope Output

The SCOPE output is a digital signal that reflects specific actions in AxoScope Software and Clampex Software, such as the beginning of an acquisition recording, sweep, event, or level. It is useful as an oscilloscope trigger, or to synchronize data acquisition with other devices.

Rear Panel

There are several connectors on the rear panel of the Digidata 1550B digitizer: four BNCs, one USB connector, one 25-pin connector, and one **AC POWER** input.



Figure 3-5: Rear panel of the Digidata 1550B digitizer.

Telegraph Inputs

The Digidata 1550B digitizer has a dedicated A/D converter that provides four telegraph input channels on the rear panel. These telegraph input channels provide gain, frequency, and capacitance values from manually-controlled amplifiers (for example, Axopatch 200B). These inputs are independent of the 8 analog input channels. Computer-controlled amplifiers (for example, MultiClamp 700A/B, Axoclamp 900A) use software telegraph signals instead of such hard-wired telegraph signals.

USB 2 Port

There is a single USB 2.0 type B female port on the rear panel for attaching a USB 2.0 cable to allow connection to the USB 2 port on the host computer.

Digital Outputs

A DB 25-pin female connector is provided as an alternative way to access the software-controlled digital outputs.



Note: Only digital outputs 0 through 7 are supported in existing Molecular Devices software. See [Appendix 5: Specifications on page 37](#) for pin definitions to make your own cable.

AC Power

There is a single AC power input connector on the rear panel for the supplied AC power line cord.

Maintenance and Troubleshooting

4

Perform only the maintenance described in this guide. Maintenance procedures other than those specified in this guide can be performed only by Molecular Devices service engineers. See [Obtaining Support on page 35](#).

Before operating the instrument or performing maintenance operations, make sure that you are familiar with the safety information in this guide. See [Safety Information on page 3](#).

The following topics describe maintenance and troubleshooting procedures that can be performed by users to ensure optimum operation of the instrument.

- [Functional Checkout](#)
- [Grounding and Minimizing Noise on page 29](#)
- [Replacing Fuses on page 30](#)
- [Troubleshooting Problems and Solutions on page 32](#)



WARNING! Service or maintenance procedures other than those specified in this guide can be performed only by trained service technicians. When service is required, contact a Molecular Devices Technical Support.

Functional Checkout

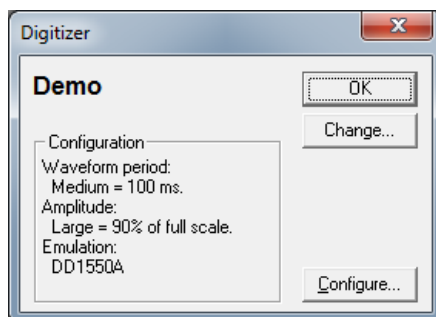
The Functional Checkout procedure provides step-by-step instructions to verify signals.

Step 1

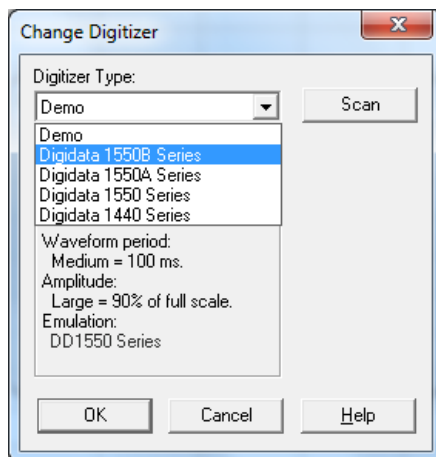
If you are able to configure the Digidata 1550B digitizer in the pCLAMP Software, then the digitizer is properly installed in Windows.

To configure the digitizer for AxoScope Software or Clampex Software:

1. Click **Configure > Digitizer**.
2. If **Digidata 1550 Series** is not displayed:
 - ◆ Click the **Change** button.

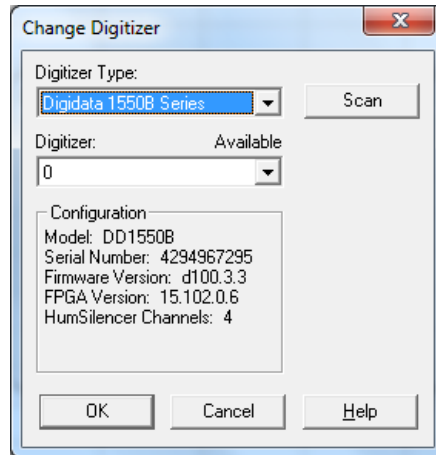


- ◆ In the **Change Digitizer** dialog, select **Digidata 1550B Series** from the **Digitizer Type** list.



- ◆ Click the **Scan** button to detect the digitizer.

The **Configuration** field should report the selected digitizer model number, serial number, firmware version, HumSilencer channel availability (0,1, or 4 = number available for use), and the **OK** button is enabled.



- ◆ (pCLAMP Software Only) If the **Configuration** field reports that **The security key is not present**, close Clampex Software, insert the provided pCLAMP 10 dongle into the computer USB port, restart Clampex Software and reconfigure the digitizer.
 - ◆ Click **OK** to exit this dialog.
3. The **Configure** button de-activates because the power-on level functionality is unsupported in the Digidata 1550B digitizer.

Step 2


Check that you have a USB 2 or USB 3 port in your computer.

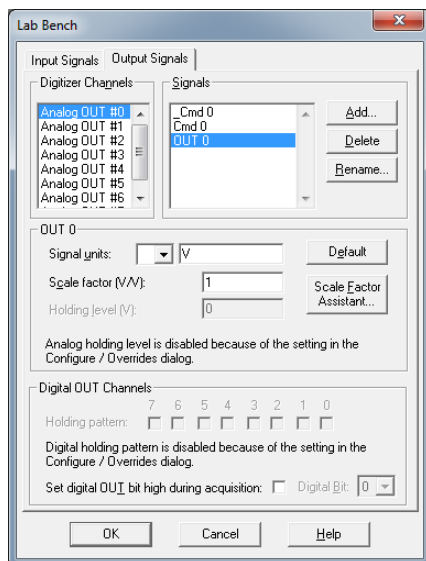
1. In Windows 7, right-click **Computer** and select **Properties**.
In Windows XP, right-click **My Computer** and select **Properties**.
2. Click **Device Manager**.
In Windows XP, click the **Hardware** tab and then click **Device Manager**.
3. Expand the **Universal Serial Bus** controllers tree.
4. If you do not have an entry for **USB 2 or USB 3**, then look for **Enhanced PCI to USB Host Controller**. “Enhanced” is a key word indicating a USB 2.0 controller.

Step 3

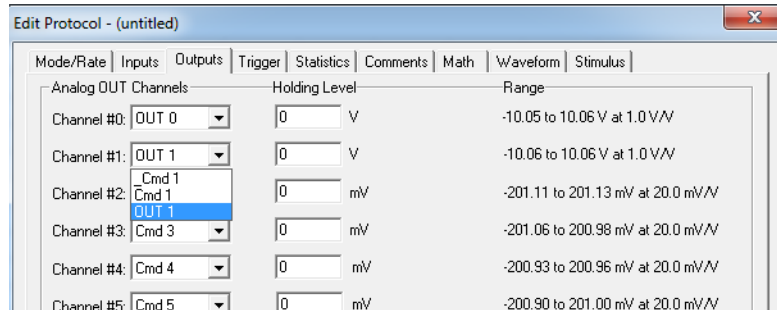
Verify analog and digital outputs signals are working.

With AxoScope Software or Clampex Software:

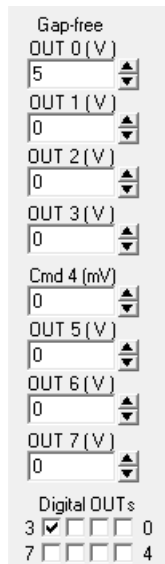
1.  Click the **Lab Bench** button (or click **Configure > Lab Bench**) and select the **Output Signals** tab. For each of the Digitizer Channels (for example, **Analog OUT #0**), select a matching **Signal** (for example, **OUT 0**), and configure that signal with unity scaling (for example, **Scale factor (V/V): 1**).



2. Set up a protocol through the **Acquire > New Protocol** menu command, and then on the **Mode/Rate** tab, select the **Gap-free** mode. On the **Outputs** tab, for each of the **Analog OUT Channels**, select the matching signal (for example, **OUT 1**) from its list.



3. Attach the digitizer's outputs to an oscilloscope or 10-bit digital volt meter (DVM).







4. For each output signal, use the software's **Real Time Controls** panel to change voltage levels. For analog outputs, either use the spinners, or type a value and press the **Enter** key. For digital outputs, click on the box corresponding to the digital bit to be tested. Verify the output signal levels on the oscilloscope or DVM.

Step 4

Verify analog inputs signals are working.



With AxoScope Software or Clampex Software:

-  Click the **Lab Bench** button (or click **Configure > Lab Bench**) and select the **Input Signal** tab. For each of the **Digitizer Channels** (for example, **Analog IN #0**), select a matching **Signal** (for example, **IN 0**), and configure that signal with unity scaling (for example, **Scale factor (V/V): 1**).
-  Click the **Edit Protocol** button (or click **Acquire > Edit Protocol**) and then, on the **Inputs** tab, for each of the **Analog IN Channels**, select the matching signal (for example, **IN 0**) from its list.
- Connect a BNC cable from the analog outputs to the analog inputs to be tested.
-  Click the **Record** button (or click **Acquire > Record**) to acquire data. For each analog output signal, use the software's **Real Time Controls** panel to change voltage levels. Either use the spinners or type a value and then press **Enter**.
-  Click the **Last Recording** button (or click **File > Last Recording**) to open the data file. Verify the input signal levels using the cursors in the window. To display a subset of the signals, right-click on the data display area, select **Properties**, and go to the **Show/Hide** tab.

Step 5

Not all Digidata 1550B digitizers use the HumSilencer adaptive noise cancellation (ANC) system. A sticker on the back of your digitizer specifies the number of ANC inputs in your digitizer (Figure 3-5 on page 21). If your unit uses ANC, verify that the HumSilencer adaptive noise cancellation system is working.

With AxoScope Software or Clampex Software:

1. Confirm in the Real Time Controls panel that the **HumSilencer > Adapt** check box is selected.
2.  Click the **Edit Protocol** button (or click **Acquire > Edit Protocol**) and then click the **Inputs** tab. Select the **Analog IN Channel #0 > HumSilencer** check box, or if your instrument uses four ANC inputs, select the **Analog IN Channel #0, #2, #4, #6 > HumSilencer** check boxes (Figure 3-2 on page 18).
3. Click the **Mode/Rate** tab. Select **Acquisition Mode > Gap-free**, and **Trial Length > Use available disk space**.
4. Click **OK** to close the **Edit Protocol** dialog.
5. Place a 50 Hz or 60 Hz noise generator, such as a power supply, near the headstage.
6.  Click the **Record** button to acquire data.
The line frequency noise should be visible on the Scope screen.
7. In the Real Time Controls panel, click **HumSilencer > Subtract**.
The line frequency noise should be eliminated.

Grounding and Minimizing Noise

The line-frequency noise, or hum, should be eliminated when HumSilencer adaptive noise cancellation is enabled and activated. The following are some additional noise minimization recommendations.

To avoid ground-loops, Molecular Devices recommends that you plug in the Digidata 1550B digitizer to the same power strip as the amplifier. Also, be aware that each Analog Input BNC on the Digidata 1550B digitizer is a single-ended input (all BNC shells are connected to signal ground).

When noise in the system occurs, the first step is diagnosis. Take all instruments out of their racks, and connect to one of them with only ONE BNC connection. Observe if the hum (50–60 Hz noise) is eliminated.

Also observe if the hum is produced from headstage pickup by shielding the headstage and watching the magnitude of the hum.

If the hum is eliminated at this step, connect the second BNC cable. If the hum is now observed, there is probably a ground loop that is picking up an alternating magnetic field. Try to eliminate the source of the alternating magnetic field from a cheap transformer or an electric motor, such as found in a nearby fan or refrigerator. Try to rearrange the two BNC cables to determine if their positioning tells you anything about the source of the alternating field. High frequency components (20–50 kHz) might also appear if there is a ground loop. These can originate from the switching power supply of the computer, or from a monitor, and can be picked up in the analog signal inputs of the Digidata 1550B digitizer.

If removing the source of the alternating field is not possible, eliminate the ground loop by constructing one of the connections between the two instruments without a shield. Make this either with a naked unshielded wire, or with a BNC cable that has its shielding cut at one end. Make a break in the shielding away from the interface, near the connection on the instrument suspected of creating the ground loop.

Additionally, the quality of the AC power should also be checked. In particular, check for proper grounding of the outlets.

For users of Molecular Devices microelectrode amplifiers, more information regarding noise reduction procedures can be found in the user guides for the MultiClamp, Axopatch, and Axoclamp amplifiers.

Replacing Fuses



WARNING! High Voltage. Always turn the power switch off and disconnect the power cord from the main power source before performing any maintenance procedure that requires removal of any panel or cover or disassembly of any interior instrument component.

Fuses burn out occasionally and must be replaced.

If the instrument does not seem to be getting power after switching it on, check to see whether the supplied power cord is securely plugged into a functioning power outlet and to the AC input connector at the rear of the instrument.

If the power failed while the instrument was on, check that the power cord is not loose or disconnected and that power to the power outlet is functioning properly.

If these checks fail to remedy the loss of power, replace the fuses. If you do not have spare fuses, you can obtain them from Molecular Devices.

For Digidata 1550B digitizer fuse specifications, see [AC Power on page 40](#).

The Digidata 1550B digitizer uses a pair of fuses located in a fuse carrier beneath the AC input connector ([Figure 4-1](#)).

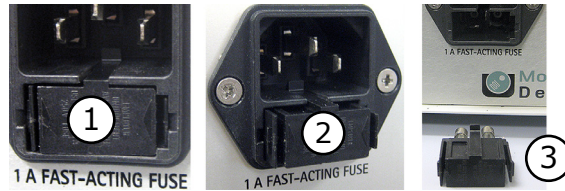


Figure 4-1: Digidata 1550B digitizer fuse carrier removal process

Item	Description
1	Digidata 1550B digitizer fuse carrier installed
2	Digidata 1550B digitizer fuse carrier released
3	Digidata 1550B digitizer fuse carrier removed

To replace the Digidata 1550B digitizer fuses:

1. Switch the power switch on the front of the instrument to the off position.
2. Unplug the power cord from the AC input connector.
3. Press the carrier-release side-tabs towards each other and then pull the fuse carrier to remove it from the instrument.
4. Gently pull the old fuses from the carrier by hand.
5. Gently place new fuses into the carrier by hand.
6. Replace the fuse carrier. The carrier-release side-tabs click when properly replaced.
7. Plug the power cord into the AC input connector.
8. Switch on power to the instrument.



Note: If the instrument still does not power on after changing the fuses, contact Molecular Devices Technical Support.

Troubleshooting Problems and Solutions

This section provides specific troubleshooting advice on possible problems and their solutions.

Before contacting Molecular Devices Technical Support regarding problems, please review this section to see if you can address the problem yourself. For more information, see [Obtaining Support on page 35](#) for faster resolution of your problem.

Isolating the Problem

The first rule in troubleshooting the digitizer or your software is to isolate the problem.

1. It is best to simplify your software configuration by turning off all other programs. It might appear that there are no other programs running in the background, but this might not be the case. To see if other programs are running in the background, in Windows, click on an empty place on the desktop and then press **Ctrl+Alt+Del** (holding these three keys down at the same time) and then select **Task Manager**.
2. On the **Applications** tab, close all unnecessary programs. Note that virus checkers and automated Internet accesses can also affect system performance.
3. Disconnect all external instruments and test the digitizer/computer combination by itself.
4. Next, swap the unit with a known good unit to help determine whether the problem is with the digitizer or the computer.

Power Light on the Front Panel Off

Make sure that the power and USB cables are firmly attached to the computer, and that the computer is powered on.

Ready Light on the Front Panel Flashes Continually

The Digidata 1550B digitizer is in a problem state. Call Technical Support at Molecular Devices for a Work Order (WO) number before returning the unit for repairs.

Problems With Analog or Digital Outputs

Check the **Lab Bench** and protocol. Use a voltmeter or oscilloscope to examine the output signals.



Note: Oscilloscopes can potentially introduce unwanted ground loops and noise.

Problems With Analog or Digital Inputs

Check the **Lab Bench** and protocol. Connect a known signal source to an analog input, such as a signal generator, or even the digitizer's analog output, if you know it is working properly.

Screen Shows a Straight Line Instead of the Input Signal

- Check if all external connections are properly made.
- Swap BNC cables to check BNC cables for continuity problems.
- Make sure the USB cable is securely attached to both the computer and the interface box.

Screen Shows Different Signal Shape Than Expected

Verify that the acquisition software is not configured for a demo digitizer (**Configure > Digitizer**). Demo mode reproduces a command waveform (with added noise), or generates artificial spike trains. Also, check the software for any inappropriate filtering. The sampling rate has to be at least 2x of the filter rate, and typically is 5x – 10x more.

Noise Introduced When Data Digitized

- Verify that the acquisition software is not configured for a demo digitizer (**Configure > Digitizer**). Demo mode reproduces a command waveform with added noise (or generates artificial spike trains).
- If noise is added to the signal on the analog input, make sure that all cables are routed away from switching power supplies, power cords, monitors, or any other major sources of noise.
- Check for proper ground connections. See [Grounding and Minimizing Noise on page 29](#) for more information on proper grounding practices.

HumSilencer Does Not Eliminate Expected Line-Frequency Noise

1. Verify that the **Analog IN Channel #0 > HumSilencer** check box is selected in the **Edit Protocol > Inputs** dialog tab.
2. Verify that the **HumSilencer > Subtract** check box is selected in the Real Time Controls panel.
3. Select the **HumSilencer > Adapt** check box in the Real Time Controls panel, then click **Clear**.
4. To see if your problem with HumSilencer is fixed, click **Record** or **View**.

Digitizer does not work properly

Digitizer does not work at all, it locks up the computer when doing certain operations, or it exhibits other strange behavior.

- Double check that you are using a USB 2.0 braided shielded cable. Improper shielding can lead to USB communication problems that manifest in a variety of odd behaviors, ranging from minor to severe.
- Reset the digitizer by turning it off and then back on. Then restart the computer.
- For Windows, reset the Windows registry digitizer settings back to the manufacturer defaults (**Start > All Programs > Molecular Devices > pCLAMP 10.6 > Reset to Program Defaults**).
- Clear relevant registry items one at a time and then reconfigure the digitizer and any Telegraphed instrument. Try clearing items such as Digitizers, Clampex Software, AxoScope Software, pCLAMP Software, and Common Settings.



Note: For application program items, all customized window settings will be lost, but signal names and protocols will be saved.

- Run a check on the computer's hard disk file structure and RAM.
- Call Technical Support if the problem persists.

Data throughput problems

- If decreasing the number of analog input channels or the sampling rate improves performance, you likely have a data throughput problem. Verify that the digitizer is connected to a high-speed USB 2.0 port on your computer. See [Installing the Digidata 1550B Digitizer on page 12](#). If the digitizer is connected to a USB hub, remove any other devices connected to the hub, or bypass the hub.
- Try the digitizer on a faster computer. CPU speed is only one part of the equation. Other relevant components include hard disk speed, RAM speed, and front-side bus speed.
- To improve data-throughput related acquisition performance problems in Clampex Software or AxoScope, Software try the following:
 - ◆ In **Configure > Lab Book Options**, select **Never log any events**.
 - ◆ In **Configure > Program Options**, select **Disable screen saver during data acquisition**.

Obtaining Support

Molecular Devices is a leading worldwide manufacturer and distributor of analytical instrumentation, software and reagents. We are committed to the quality of our products and to fully supporting our customers with the highest possible level of technical service.

Our support web site, www.moleculardevices.com/support.html, has a link to the Knowledge Base with Conventional Electrophysiology technical notes, software upgrades, safety data sheets, and other resources. If you do not find the answers you are seeking, follow the links to the Technical Support Service Request Form to send an email message to a pool of technical support representatives.

Please have your instrument serial number or Work Order number, and your software version number available when you call.

Before you call

To help us to more quickly identify possible problems and known conflicts, before you call Molecular Devices Technical Support, be ready to provide the following information:

1. What is the model and serial number of the digitizer? The serial number is on a small barcode sticker on the digitizer's back panel.
2. The specific software name and version of the software running the digitizer. For example, Clampex Software Version 10.6.0.1. Click **Help > About Clampex**.
3. If you can reproduce a problem by following a series of steps, please write them down so that we can follow your exact steps.
4. Email a copy of the protocol(s) and data file(s) that illustrate your problem. This helps in understanding and duplicating your problem.

Clampex Software users:

1. Connect **Analog Out 0** to **Analog In 0**.
2. From **Acquire > New Protocol**, run an **Episodic stimulation** mode protocol with a default waveform specified.
3. Click the **View Only** button. Do you see the default waveform?

You can contact your local representative or contact Molecular Devices Technical Support by telephone at 800-635-5577 (U.S. only) or +1 408-747-1700.

Specifications



This section lists instrument specifications, electrical requirements, instrument dimensions, and space requirements for the Digidata 1550B digitizer.

Analog Inputs

Table 5-1: Analog Inputs

Input Name	Description
Number of channels	8 ¹
Type of channels	single-ended
Resolution	16-bit, 1 in 65536
Sample rates per channel	1 Hz to 500 kHz
Input range	-10.000 V to +10.000 V
Input resistance (DC)	> 1 MΩ
Gain value	1
Digitization noise	< ±1 mV Avg (p-p)
Crosstalk noise	< ±1 mV Avg (p-p)

1. Depending on the model, Analog Input Channels #0 #2, #4, and #6 are configurable with the HumSilencer system.

Analog Outputs

Table 5-2: Analog Outputs

Output Name	Description
Number of channels	8
Resolution	16-bit
Sample rates per channel	1 Hz to 500 kHz
Output range	-10.000 V to +10.000 V
Output impedance (DC)	< 0.5 Ω
Output short circuit to signal ground	± 25 mA

Digital Inputs

Table 5-3: Digital Inputs

Input Name	Description
Input type	5 V nominal, >4 V high threshold
START trigger	rising-edge sensitive
TAG trigger	rising-edge sensitive

Digital Outputs

Table 5-4: Digital Outputs

Output Name	Description
Number of bits	16 (8 supported in software)
Output driver	advanced CMOS (AC) compatible
Output current	± 4 mA
SCOPE trigger	shared bit on DO #15

A DB 25-pin female connector is provided on the rear panel with pin assignments as listed in [Table 5-5: Pin Assignments](#).

Table 5-5: Pin Assignments

Pin number	Digital Output
1	0
2	2
3	4
4	6
5	N/C
6	Analog ground
7	Analog ground
8	8
9	10
10	12
11	Internal Use (or 14)
12	Analog ground
13	Analog ground
14	1
15	3
16	5
17	7
18	Analog ground
19	Analog ground
20	Analog ground
21	9
22	11
23	Internal Use (or 13)
24	Scope Output (or 15) ¹
25	Analog ground

1. Pin 24 is configured as the front panel SCOPE output, using the hardware's 16th digital bit (15).

Telegraph Inputs

Table 5-6: Telegraph Inputs

Input Name	Description
Number of channels	4
Sample rates per channel	40 kHz
Input range	± 10.0 V

HumSilencer Adaptive Noise Cancellation Module

The HumSilencer Adaptive Noise Cancellation module is an optional configuration of the Digidata 1550B digitizer.

Table 5-7: HumSilencer Adaptive Noise Cancellation

Description	
Maximum Input Signal (total of noise + signal)	± 10 V
Maximum Noise Amplitude	20 V peak-to-peak (on a 0 V signal)
Noise Cancellation	Line-frequency (50 Hz / 60 Hz) and harmonics up to 10 kHz
Cancellation Response Time	< 1 second

AC Power

The AC Power is supplied from a single AC input connector on the rear panel for the supplied AC power line cord.

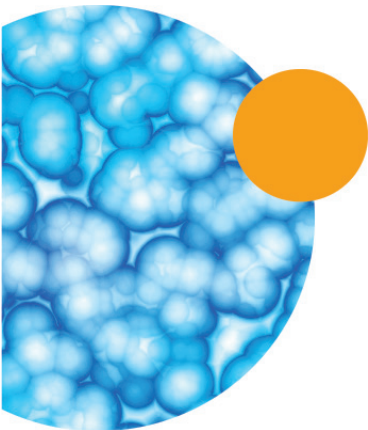
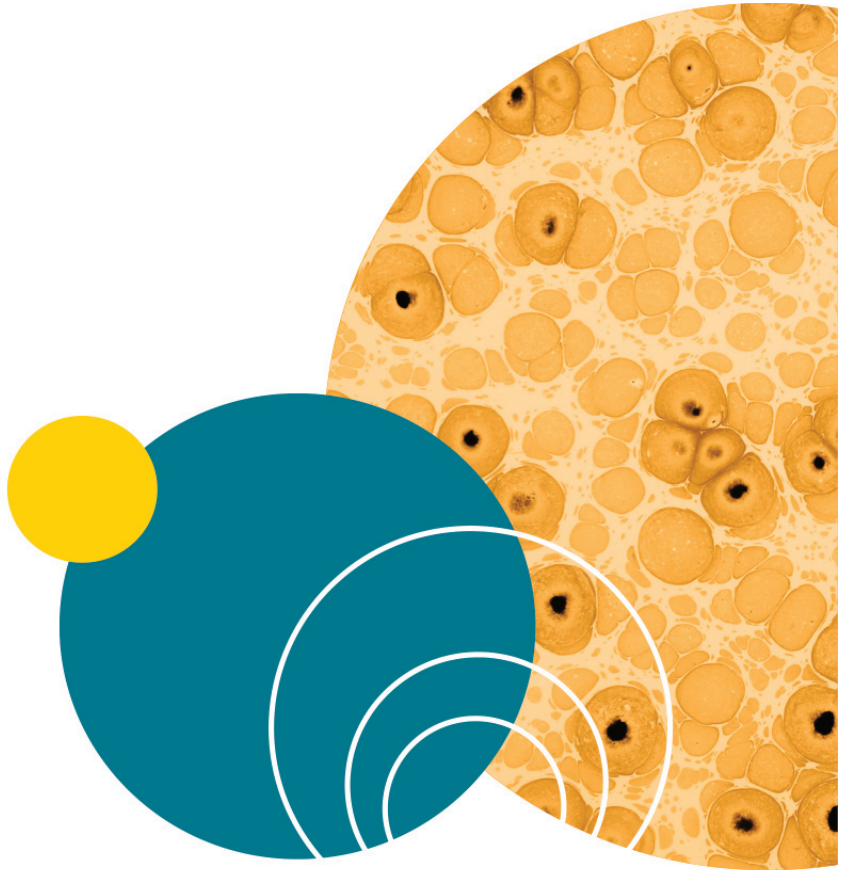
Table 5-8: AC Power

Voltage	Description
Voltage input rating	100 V–240 V AC, 50/60 Hz 50 W Max.
Replaceable fuse type	Cartridge, fast acting
Fuse dimensions	6.3 mm x 35 mm
Fuse rating	1.0 Ampere, 250 V

Operational and Environmental

Table 5-9: Operational and Environmental Specifications

Specification	Measurement
Weight	3.6 kg
Dimensions (H x W x D)	109 mm x 483 mm x 363 mm
Mains Power Input	100 – 240 VAC, 50/60 Hz, Max. 50 W
Mains Voltage Fluctuations	Not to exceed 10% of nominal supply voltage
Equipment Class	1
Pollution Degree	2
Installation Category	2
Operating Environment	Indoor Use Only
Altitude	Not to exceed 2000 m
Operating temperature:	15 to 30 °C (59 to 86 °F)
Humidity	< 80% RH at 25 °C (77 °F)
Ingress Protection:	IP20



Electromagnetic Compatibility (EMC)

REGULATORY INFORMATION FOR CANADA (ICES/NMB-001:2006)

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

ISM EQUIPMENT CLASSIFICATION (Group 1, Class A)

This equipment is designated as scientific equipment for laboratory use that intentionally generate and/or use conductively coupled radio-frequency energy for internal functioning, and are suitable for use in all establishments, other than domestic and those directly connected to a low voltage power supply network which supply buildings used for domestic purposes.

INFORMATION FOR THE USER (FCC NOTICE)

This equipment has been tested and found to comply with the limits for non-consumer ISM equipment, pursuant to part 18 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a non-residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

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