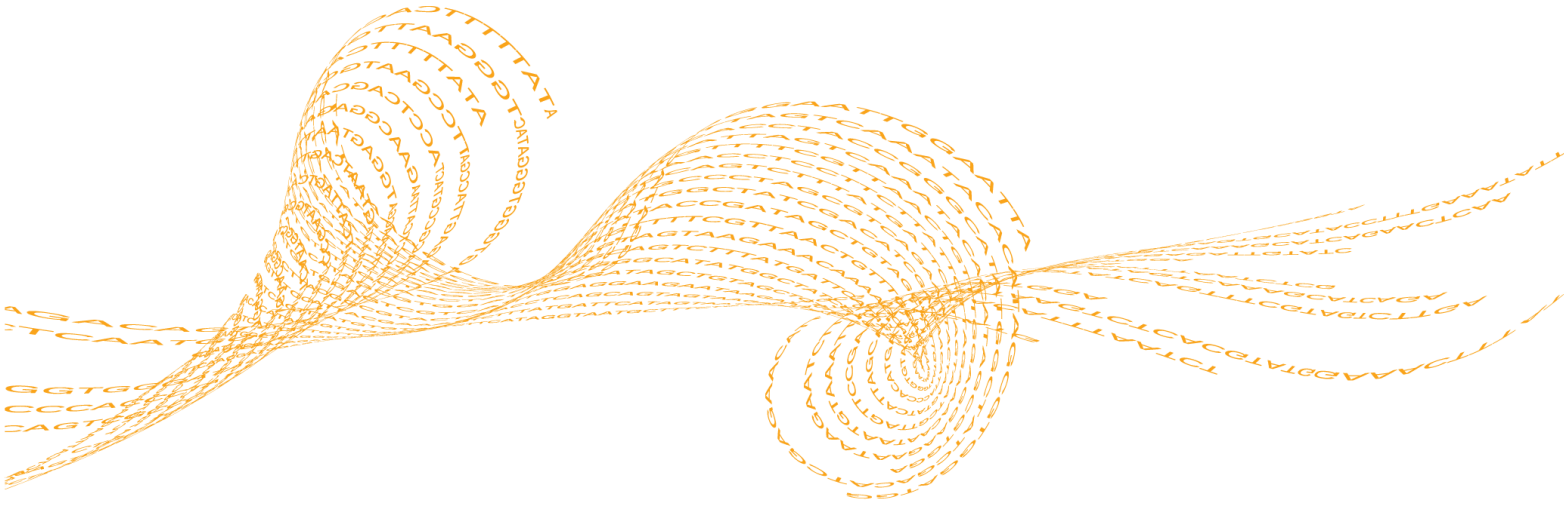
HiSeq 2500, 1500, and 2000 Systems

Site Prep Guide

For Research Use Only. Not for use in diagnostic procedures.



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Document # 15006407 v01
February 2016

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Introduction

This guide provides specifications and guidelines for preparing your site for installation and operation of the Illumina® HiSeq® 2500, HiSeq 1500, or HiSeq 2000 system.

- Laboratory space requirements
- Electrical requirements
- Environmental constraints
- Computing requirements
- User-supplied consumables and equipment

System Configuration

The HiSeq system comprises the instrument, monitor, instrument control computer, barcode scanner, keyboard, mouse, and universal power supply. The instrument control computer is a dedicated subsystem of the instrument and is not intended for use as a general-purpose computer.

Additional Resources

The following documentation is available for download from the Illumina website.

Resource	Description
HiSeq 2500 System Safety and Compliance Guide (document # 1000000000651) *HiSeq 1500 and HiSeq 2000 Safety and Compliance Guide (document # 1000000000665)*	Provides information about instrument labeling, compliance certifications, and safety considerations.
HiSeq and GAIIx Systems Denature and Dilute Libraries Guide (document # 15050107)	Provides instructions for denaturing and diluting prepared libraries for a sequencing run, and preparing a PhiX control. This step applies to most library types.
HiSeq 2500 System Guide (document # 15035786) *HiSeq 1500 System Guide (document # 15035788)* *HiSeq 2000 System Guide (document # 15011190)*	Provides an overview of instrument components and software, instructions for performing sequencing runs, and procedures for proper instrument maintenance and troubleshooting.

Visit the HiSeq 2500, HiSeq 1500, or HiSeq 2000 support page on the Illumina website for access to documentation, software downloads, online training, and frequently asked questions.

Delivery and Installation

An authorized service provider delivers the system, uncrates components, and places the instrument on the lab bench. Make sure that the lab space and bench are ready before delivery.

CAUTION
Only authorized personnel can uncrate, install, or move the instrument. Mishandling of the instrument can affect the alignment or damage instrument components.

An Illumina representative installs and prepares the instrument. When connecting the instrument to a data management system or remote network location, make sure that the path for data storage is selected before the date of installation. The Illumina representative can test the data transfer process during installation.

CAUTION
After your Illumina representative has installed and prepared the instrument, ***do not*** relocate the instrument. Moving the instrument improperly can affect the optical alignment and compromise data integrity. If you have to relocate the instrument, contact your Illumina representative.

Crate Dimensions and Contents

The HiSeq instrument and components are shipped in 3 crates. Use the following dimensions to determine the minimum door width required to accommodate the shipping crates.

- Crate #1 contains the instrument.
- Crate #2 contains an uninterruptible power supply (Japan, North America, or an international version).
- Crate #3 contains the following items:
  - Instrument control computer, monitor, and monitor arm
  - Waste bottle and reagent racks
  - Instrument panels
  - Power cords—1 domestic power cord or 3 international power cords (UK, EU, and China)

Measurement	Crate #1: Instrument	Crate #2: UPS	Crate #3: Computer, Covers, and Power Cords
Width	165 cm (65 in)	78 cm (31 in)	115 cm (45 in)
Height	122 cm (48 in)	51 cm (20 in)	102 cm (40 in)
Depth	107 cm (42 in)	61 cm (24 in)	82 cm (32 in)
Weight	317 kg (698 lb)	81 kg (177 lb)	125 kg (265 lb)

Laboratory Requirements

Use the following specifications and guidelines to determine required lab space.

Instrument Dimensions

The instrument and instrument control computer have the following dimensions after installation.

Dimension	Instrument	Instrument Control Computer
Width	118.6 cm (46.7 in) The waste bottle extends an additional 10 cm (4.0 in) on the right side of the instrument.	18 cm (7.0 in)
Height	94 cm (37.0 in) minimum The instrument height is adjustable to an additional 1.27 cm (0.5 in).	45 cm (17.7 in)
Depth	76 cm (30.0 in) The keyboard tray extends an additional 19 cm (7.5 in) from the front panel.	28 cm (11.0 in)
Weight	226 kg (498 lb)	34 kg (75 lb)

Placement Requirements

The following requirements ensure access to the instrument power switch and power outlet, allow proper ventilation, and provide sufficient access for servicing the instrument.

- Position the instrument so that personnel can reach around the right-side of the instrument to turn on or turn off the power switch on the back panel adjacent to the power cord.
- Position the instrument so that personnel can quickly disconnect the power cord from the outlet.
- Make sure that the instrument is accessible from all sides using the following minimum clearance dimensions.

Access	Minimum Clearance
Sides	Allow at least 61 cm (24 in) on each side of the instrument.
Rear	Allow at least 10.2 cm (4 in) behind the instrument.
Top	Allow at least 61 cm (24 in) above the instrument. If the instrument is positioned under a shelf, make sure that the minimum clearance requirement is met.

Lab Bench Guidelines for the HiSeq

Place the HiSeq on a mobile lab bench with locking casters and a bottom shelf capable of supporting the instrument control computer. The bench must support the weight of the instrument and instrument control computer.

Width	Height	Depth	Locking Casters
152.4 cm (60 in)	76.2–91.4 cm (30–36 in)	76.2 cm (30 in)	Yes

For North American customers, Illumina recommends the following mobile lab benches: Bench-Craft (www.bench-craft.com), part # HS-30-60-30 P2 with casters or part # HS-30-60-36 P2 with casters.

- **HS** indicates standard bench
- **30-60-30** indicates 30 inch wide x 60 inch long x 30 inch high
- **30-60-36** indicates 30 inch wide x 60 inch long x 36 inch high
- **P2** indicates outlets on rear of bench

You can order any of the following casters for use with either of the recommended lab benches.

Caster	Supplier
Zinc casters	Bench-Craft, part # C-ML4**TPS
Medical-grade composite casters	Bench-Craft, part # PZT40120GR-TPR33(GG)
Stainless steel casters	Bench-Craft, part # 94-20-DADI-M-PO-SS-TL

Vibration Guidelines

Use the following guidelines to minimize vibrations during sequencing runs and ensure optimal performance:

- Place the instrument on a sturdy immobilized lab bench.
- Do not install the instrument near frequently used doors. Opening and closing of doors might induce vibrations.
- Do not install a keyboard tray that hangs below the bench.
- Do not place other equipment on the bench that can produce vibrations, such as a shaker, vortexer, centrifuge, or instruments with heavy fans.
- Do not place objects on top of the instrument.

Electrical Requirements

The following specifications describe electrical requirements for operating the instrument.

Power Specifications

Type	Specification
Line Voltage	100–240 VAC at 50–60 Hz
Power Consumption	Maximum 1500 Watts combined for the instrument, monitor, and work station

Receptacles

Your facility must be wired with the following equipment.

- **For 100–120 Volts AC**—A 20-amp grounded dedicated line with proper voltage and electrical ground is required.
  North America and Japan—Receptacle: NEMA 5-20
  Interpower Corp. Receptacle, part # 88030080 (or equivalent)
- **For 200–240 Volts AC**—At minimum, 10-amp grounded line with proper voltage and electrical ground is required. Use a higher rating as needed according to requirements for your region.
- If the voltage fluctuates more than 10%, a power line regulator is required.

Protective Earth

The instrument has a connection to protective earth through the enclosure. The safety ground on the power cord returns protective earth to a safe reference. The protective earth connection on the power cord must be in good working condition when using this device.

Power Cords

The instrument is equipped with an international standard IEC 60320 C13 receptacle and is shipped with a region-specific power cord.

Hazardous voltages are removed from the instrument only when the power cord is disconnected from the AC power source.

To obtain equivalent receptacles or power cords that comply with local standards, consult a third-party supplier such as Interpower Corporation (www.interpower.com).

CAUTION
Never use an extension cord to connect the instrument to a power supply.

Fuses

Only Illumina field personnel are qualified to replace internal fuses. The power entry module includes 2 input fuses on the high-voltage input lines. The fuses are size 5x20 and rated for 10 Amps, 250 VAC, Slo-Blo.

Uninterruptible Power Supply

The instrument is shipped with a region-specific uninterruptible power supply (UPS).

- **Japan**—APC SmartUPS 2200VA Model SUA2200JB
- **North America**—APC SmartUPS 2200VA Model SUA2200XL
- **International**—APC SmartUPS 2200VA Model SUA2200XLI

Specification	Japan	North America	International
Maximum Watts	1980 W	1980 W	1980 W
Maximum Current	2200 VA	2200 VA	2200 VA
Input Voltage (nominal)	100 VAC	120 VAC	230 VAC
Input Connection	NEMA L5-30P	NEMA 5-20P	IEC-320 C20 Schuko CEE 7/EU1-16P British BS1363A
Typical Run Time (50% load)	28.5 minutes	28.5 minutes	28.5 minutes
Typical Run Time (100% load)	10.4 minutes	10.4 minutes	10.4 minutes

To obtain an equivalent UPS that complies with local standards for facilities outside the referenced regions, consult a third-party supplier such as Interpower Corporation (www.interpower.com).

NOTE

The UPS ***cannot*** maintain the instrument during an extended power outage. Illumina recommends that the UPS receptacle is connected to a backup electrical source, such as a generator, to ensure minimal loss of data during an extended power outage.

Environmental Considerations

Element	Specification
Temperature	Maintain a lab temperature of 19°C to 25°C (22°C ±3°C). This temperature is the operating temperature of the instrument. During a run, do not allow the ambient temperature to vary more than ±2°C.
Humidity	Maintain a noncondensing relative humidity between 20–80%.
Elevation	Locate the instrument at an altitude below 2000 meters (6500 feet).
Air Quality	Operate the instrument in a Pollution Degree II environment or better. A Pollution Degree II environment is defined as an environment that normally includes only nonconductive pollutants.
Ventilation	Consult your facilities department for ventilation requirements based on the instrument heat output specifications.

Noise Output

Noise output is 65 dB when standing 1 meter (3.3 feet) from the front of the instrument.

Heat Output

Measured power is 1500 Watts for the combined instrument, computer, and monitor under normal operating conditions. Thermal output is 5100 BTU/hour.

CAUTION

Do not operate the HiSeq with any of the panels removed. Do not touch the temperature station in the imaging compartment. The Peltier effect heater used in the stage area is normally controlled between ambient room temperature (22°C) and 85°C. Exposure to temperatures at the upper end of this range could result in burns.

Instrument Control Computer

The instrument is shipped with an instrument control computer that is customized to the latest system requirements. Contact Illumina Technical Support for more information about the computer specifications.

The instrument control computer is a dedicated subsystem of the instrument and is not intended for use or supported as a general-purpose computer. Loading and using third-party software can result in slow processing, loss of data, or invalid data.

Data Connections

The HiSeq has 3 connections to the controlling computer:

- One USB connection for communication between the instrument and the computer. A standard USB type A to type B style connector is used.
- Two low voltage differential signaling (LVDS) CameraLink connections for the 2 main cameras. Standard CameraLink cables are used. The cameras transfer raw data from the instrument to the computer.

Antivirus Software

An antivirus software of your choice is highly recommended to protect the instrument control computer against viruses.

To avoid data loss or interruptions, configure the antivirus software as follows:

- Set for manual scans. Do not enable automatic scans.
- Perform manual scans only when the instrument is not in use.
- Set updates to download without user authorization, but not install.
- Do not update during instrument operation. Update only when the instrument is not running and when it is safe to reboot the instrument computer.
- Do not reboot the computer automatically upon update.
- Exclude the application directory and data drives from any real-time file system protection. Apply this setting to the C:\Illumina directory, D:\ drive, and E:\ drive.

Network Considerations

Illumina does not provide installation or technical support for networking the instrument control computer. However, you can configure and maintain a network connection on the instrument control computer after installation of the instrument.

- Use a 1 gigabit connection between the instrument control computer and your data management system. This connection can be made directly or through a network switch.
- If you are using BaseSpace, Illumina recommends a minimum network connection speed of 10 Mbps.

  NOTE
  Illumina does not recommend or support using a greater than 1 gigabit connection per instrument control computer, such as a Fiber Channel PCI card.

- Upon connection to a network, configure Windows Update so that the HiSeq does not automatically update. Illumina recommends waiting 1 month after a Windows release before allowing an update.

Network Support

Illumina does not install or provide technical support for network connections.

Review network maintenance activities for potential compatibility risks with the Illumina system, including the following risks:

- **Removal of the Group Policy Objects (GPOs)**—GPOs can affect the operating system (OS) of connected Illumina resources. OS changes can disrupt the proprietary software in Illumina systems.
- Illumina instruments have been tested and verified to operate correctly. After connecting to domain GPOs, some settings might affect the instrument software. If the instrument software operates incorrectly, consult your facility IT administrator about possible GPO interference.
- **Activation of Windows Firewall and Windows Defender**—These Windows products can affect the OS resources used by Illumina software. Install antivirus software to protect the instrument control computer.
- **Changes to the privileges of preconfigured users**—Maintain existing privileges for preconfigured users. Make preconfigured users unavailable as needed.

Multiple Instruments

- Make sure that the server drive is sufficient for the high volume of data being transferred from multiple instruments. Consider setting up the instruments to copy to different servers.
- If multiple sequencing instruments share a connection to copy to their target servers, the connection might not be sufficient to handle the transfer of data. Consider setting up the instruments to use different connections.

Data Processing and Analysis

IlluminaCompute is a complete genomic data processing solution that provides a scalable computing architecture for human-scale genomic data processing and analysis. IlluminaCompute comprises hardware, software, and support services that can be deployed quickly and without preexisting computer infrastructure.

The following table describes the standard IlluminaCompute solutions and provides a basis for estimating the scale of the computing solution you might require.

IlluminaCompute Solution	Standard System	Advanced System	Elite System
Number of HiScanSQ™ systems supported	4	8	16
Number of HiSeq 1500 systems supported	2	4–14	8–592
Number of HiSeq 2500 systems supported	1 (100 Gb run)	2–7	4–296
Expandable storage	Yes	Yes	Yes
Expandable compute	No	Yes	Yes
On-site configuration and installation	Yes	Yes	Yes
IlluminaCompute software suite	Yes	Yes	Yes
Genomes stored (human BAMs)	200–400	220–770	660–280,000
Data per day	100 Gb/0.8 genomes	200–1000 Gb/1.7–8.3 genomes	500–35,500 Gb/4.2–296 genomes
Days per CASAVA run (100 Gb/600 Gb)[1]	1 day/5.5 days	15 hours/1.5 days	4 hours/1 day

[1] CASAVA analysis begins at the end of a sequencing run.

The following table describes the IlluminaCompute components. For more information, contact your Illumina sales representative.

IlluminaCompute System Component	Standard System	Advanced System	Elite System
Isilon folder-based data segregation and PB scalability	No	Yes	Yes
I/O bandwidths scaling from 500 MB/s to many GB/s	No	Yes	No
Dell rackmount servers with 4 GB RAM per core	Yes	Yes	Yes
Dell M610 blades with 4 GB RAM per core	No	No	Yes
Fault-tolerant, high availability blade chassis	No	No	Yes
10 Gbit/s bandwidth	No	Yes	Yes
Low power consumption and heat generation	Yes	Yes	Yes
CASAVA, Off-Line Basecaller, Platform Cluster Manager, Open Grid Scheduler for job scheduling	Yes	Yes	Yes
Usable disk space (TB)	20–40	22–77	66–2800
GB of memory	128	144–624	384–27,264
Gb throughput/day	100	200–1000	500–35,500

User-Supplied Consumables and Equipment

The following user-supplied consumables and equipment are required for a sequencing run on the HiSeq.

User-Supplied Consumables

Consumable	Supplier	Purpose
Alcohol wipes, 70% Isopropyl or Ethanol, 70%	VWR, catalog # 95041-714 General lab supplier	Cleaning the flow cell and flow cell stage.
Carboy, at least 6 liters	General lab supplier	Preparing maintenance wash solution.
Centrifuge tubes, 250 ml	Corning, catalog # 430776	SBS reagent racks, positions containing PW1. Instrument wash.
Conical tubes, 15 ml	Corning, catalog # 430052	PE reagent racks, positions containing PW1. Instrument wash. Collecting and measuring waste volumes.
Conical tubes, 50 ml, self-standing (optional)	Corning, catalog # 430921	Storing flow cells.
Disposable gloves, powder-free	General lab supplier	General use.
Lab tissue, low-lint	VWR, catalog # 21905-026	Cleaning the flow cell holder.
Lens paper, 4 x 6 in	VWR, catalog # 52846-001	Cleaning the flow cell.
Pipette tips, 200 µl	General lab supplier	Splitting reagent volumes.
Pipette tips, 1000 µl	General lab supplier	Splitting reagent volumes.
ProClin 300, 50 ml	Sigma-Aldrich, catalog # 48912-U	Maintenance wash.
Tween 20, viscous liquid, 100 ml	Sigma-Aldrich, catalog # P7949	Maintenance wash.
Tweezers, square plastic tip	McMaster-Carr, catalog # 7003A22	Removing the flow cell gaskets.
Water, laboratory-grade, 18 M Ohm	Millipore	SBS and PE reagent racks, positions containing PW1. Instrument wash.

Microcentrifuge Tubes for Rapid Run Mode

Consumable	Supplier
Microcentrifuge tube, 1.5 ml	VWR, catalog # 20170-038, catalog # 20170-650, or catalog # 89000-028 Axygen, catalog # MCT-150-C
Microcentrifuge tube, 1.7 ml	VWR, catalog # 20170-575 Axygen, catalog # MCT-175-C Sorenson BioScience, catalog # 16070

Guidelines for Laboratory-Grade Water

Always use laboratory-grade water or deionized water to perform instrument procedures. Never use tap water. Use only the following grades of water or equivalents:

- Deionized water

- Illumina PW1
- 18 Megohm (MΩ) water
- Milli-Q water
- Super-Q water
- Molecular biology-grade water

User-Supplied Equipment

Item	Source
Balance, top-loading, digital, 420 g capacity	Sartorius, Model CPA423S (or similar)
Bottle rack, 6-position 250 ml centrifuge tube, epoxy-coated	LabScientific, catalog # CBR 200
Freezer, -25°C to -15°C	General lab supplier
Ice bucket	General lab supplier
Refrigerator, 2°C to 8°C	General lab supplier
Stir bar, large	General lab supplier
Stir plate	General lab supplier
Tweezers, square-tip plastic	McMaster-Carr, catalog # 7003A22 (or similar)

Revision History

Document	Date	Description of Change
Document # 15006407 v01	February 2016	Updated lab bench guidelines to include an additional lab bench option and casters for either bench option. Updated guidelines for laboratory-grade water to include deionized water as an acceptable form of water for performing instrument procedures. Added carboy to user-supplied consumables, and stir bar and stir plate to user-supplied equipment. Added the section Additional Resources, which lists documentation and web resources for the HiSeq. Corrected the following specifications: • Weight and crated weight • Thermal output
Part # 15006407 Rev. I*	August 2014	Updated VWR catalog # for alcohol wipes to 95041-714. Updated antivirus software recommendation to include drive and folder names. Added information about Windows Update configuration. Moved network connection recommendation to a new section on network support. Updated network connection recommendations to include the following compatibility risks: • Removal of Group Policy Objects (GPOs). • Activation of Windows Firewall and Windows Defender. • Changing the privileges of preconfigured users. Updated SDS link to support.illumina.com/sds.html.

*The history for Revisions A–H is unavailable for this guide.

Notes

Technical Assistance

For technical assistance, contact Illumina Technical Support.

Table 1 Illumina General Contact Information

Website	www.illumina.com
Email	techsupport@illumina.com

Table 2 Illumina Customer Support Telephone Numbers

Region	Contact Number	Region	Contact Number
North America	1.800.809.4566	Japan	0800.111.5011
Australia	1.800.775.688	Netherlands	0800.0223859
Austria	0800.296575	New Zealand	0800.451.650
Belgium	0800.81102	Norway	800.16836
China	400.635.9898	Singapore	1.800.579.2745
Denmark	80882346	Spain	900.812168
Finland	0800.918363	Sweden	020790181
France	0800.911850	Switzerland	0800.563118
Germany	0800.180.8994	Taiwan	00806651752
Hong Kong	800960230	United Kingdom	0800.917.0041
Ireland	1.800.812949	Other countries	+44.1799.534000
Italy	800.874909		

Safety data sheets (SDSs)—Available on the Illumina website at support.illumina.com/sds.html.

Product documentation—Available for download in PDF from the Illumina website. Go to support.illumina.com, select a product, then select **Documentation & Literature**.

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