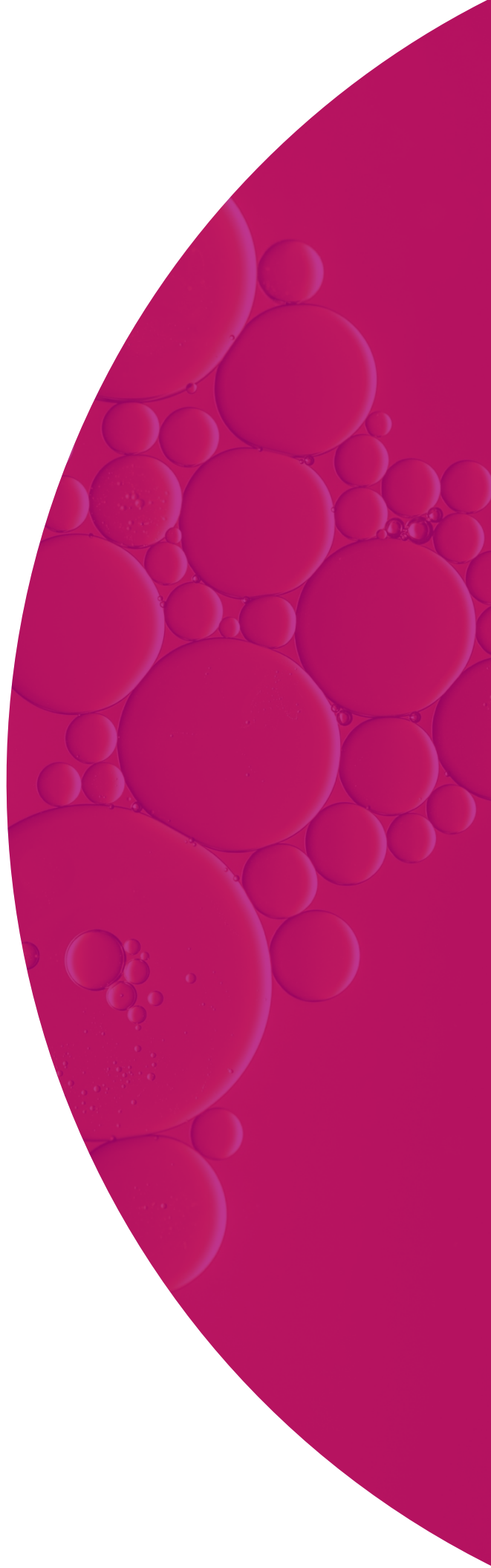




# Revio<sup>®</sup> system

Site preparation guide



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

PN 102-978-500-06

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# Introduction

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The site preparation guide explains how to prepare your physical laboratory to accommodate the Revio sequencing system. PacBio® personnel will support you to install and test the system.

SMRT® Link software must be installed on the computer network to which the Revio system will be attached by the scheduled physical installation date. If SMRT Link is not available, then PacBio maintains the option to complete the instrument installation process (including Installation Completion Testing), without connecting the Revio system to the customer computer network.

A PacBio representative will contact you, at least 2 weeks prior to shipment, to confirm that site preparation is complete. Be sure to point out any potential installation limitations or hindrances to the installation.

## Overall site preparation recommendations

- Read and familiarize yourself with all of the safety information, symbols, and conventions.
- Assign the required personnel.
- Select the site and space.
- Complete all environmental, electrical, and computer requirements.
- Ensure your site is appropriately stocked with the needed materials. Only supported consumables and accessories may be used with the Revio systems.
- Install the most recent version of SMRT Link software.
- In cases of limited user accessibility to the instrument work deck or controls, appropriate accommodations must be made by your site according to local regulations.

## Safety considerations


Safety notes, cautions and warnings are contained in this Guide. Read and follow all safety recommendations.

# Delivery and installation

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An authorized service provider contracted through PacBio delivers the system, uncrates and unboxes the components and places the instruments. Ensure the lab space is ready before delivery.

**Important:** Consumables may be delivered at a different time. When consumables arrive, immediately place them in suitable cold storage according to the packaging label.

	<b>Caution:</b> Only authorized personnel can uncrate, install, or move the instrument and other system devices.
	<b>Caution:</b> <b>ELECTRICAL SHOCK AND LASER HAZARD</b> Installation, maintenance and repair are only allowed for authorized service personnel. Do not remove the panels of the Revio systems.

## For more information

For more information or support, contact your PacBio representative or call 1-877-920-7222.

## Estimated shipping dimensions and weights

For delivery of the Revio system, the following should be considered:

Description	Crate dimensions (W x D x H)	Empty crate weight	Total shipping weight Including loaded crate (gross weight)
Instrument	49.0 x 45.4 x 87.0 in	365 lbs	1,400 lbs
	125.7 x 115.3 x 220.4 cm	166 kg	635 kg

## Equipment and materials for installation

Equipment	Quantity	Source
Ice bucket	1	Major Laboratory Supplier (MLS)
Ice	1	MLS
Lab gloves	1	MLS
Vortex-Genie shaker	1	VWR Catalog No. 14005-824
Plate centrifuge	1	MLS
Micropipettors and filter tips for p2, p10, p20, p100, p200, p1000	1	Thermo Fisher Scientific, Rainin (Mettler Toledo), USA Scientific
Molecular Biology Grade H <sub>2</sub> O	1	MLS
Isopropyl Alcohol (70%-99%)	1	MLS
Centrifuge tubes	1	Thermo Fisher Scientific, Rainin (Mettler Toledo), USA Scientific

## Required personnel

This section assigns certain tasks to various personnel in an effort to have all aspects of system receipt, installation, and operation proceed as planned.

To minimize the time between shipment arrival and system installation:

- Complete the site preparation requirements and fill out the corresponding Revio system site preparation requirements checklist (Checklist).
- Schedule installation before the System shipment arrives.
- Verify with a PacBio representative (who will contact you) that:
  - All tasks and the Checklist are complete.
  - The purchase order is complete.

## Site preparation manager

- Reviews this Site Preparation Guide for requirements and chooses the installation site.
- Coordinates required personnel and tasks.
- Orders required materials.
- Reviews the Checklist with appropriate personnel, then with the PacBio Service Engineer to verify that the site is properly prepared.
- Receives the system.
- Schedules the installation and informs personnel of the installation date.
- Ensures that the site is clear of unnecessary materials on the installation day.
- Is available to assist the Service Engineer throughout installation.

## Laboratory safety manager

- Reviews this Site preparation guide for safety information.
- Ensures that the required safety practices and equipment are in place.
- Is available to assist the Service Engineer throughout system installation.

## Laboratory personnel

- A primary user who will be trained during installation and will be responsible for training other users.
- Ensures that customer-supplied materials are on hand.

## Facilities manager

- Ensures that installation requirements are met for:
  - Space at the installation site
  - Building clearances
  - Temperature and humidity
  - HVAC capacity
  - Waste collection
  - Electrical supply
  - Computer
  - Safety and installation materials
- Is available to assist the Service Engineer and laboratory personnel throughout installation.

## Network/IT manager

- Ensures all connections, setup, and installation requirements are complete prior to instrument installation.
- Ensures all requirements set forth in the Checklist are complete.
- If necessary, supplies additional cables
- Is available during installation to connect the System to the network

# Space requirements

The System will be shipped in one crate. Additional boxes may be included in the shipment, depending on the products ordered. See above for estimated shipping weights.

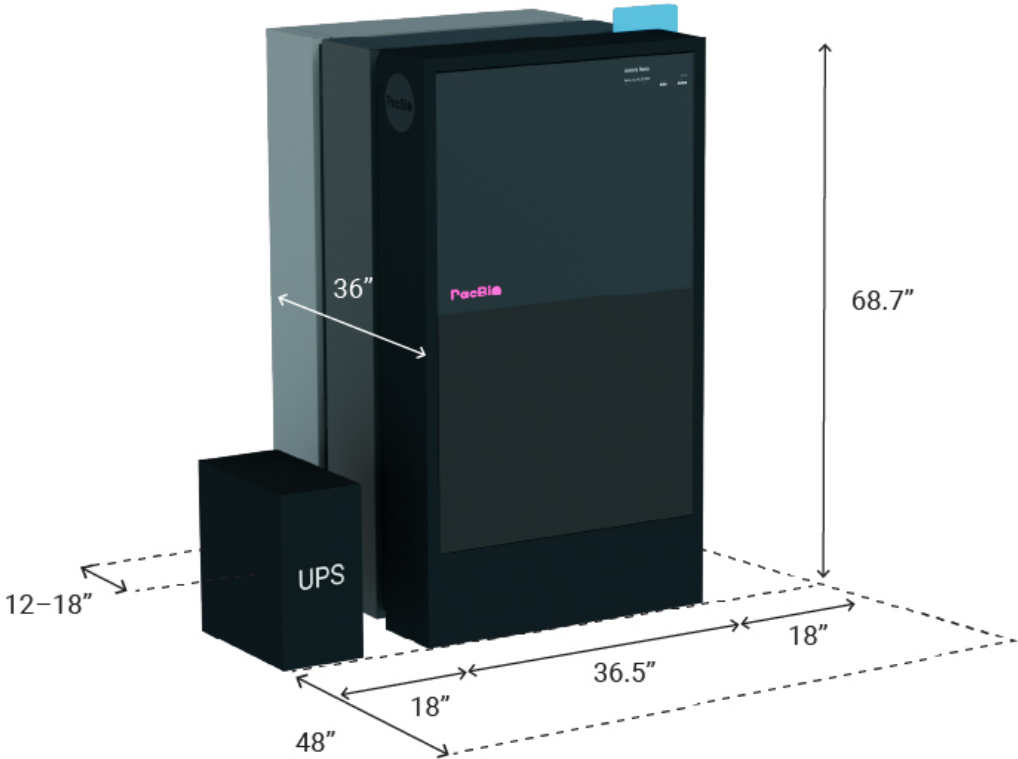
**Important:** PacBio Service Engineers will come to your site to uncrate the instrument and move it to the installation location. Please do not attempt to uncrate the instrument.

## Installed system weight and dimensions

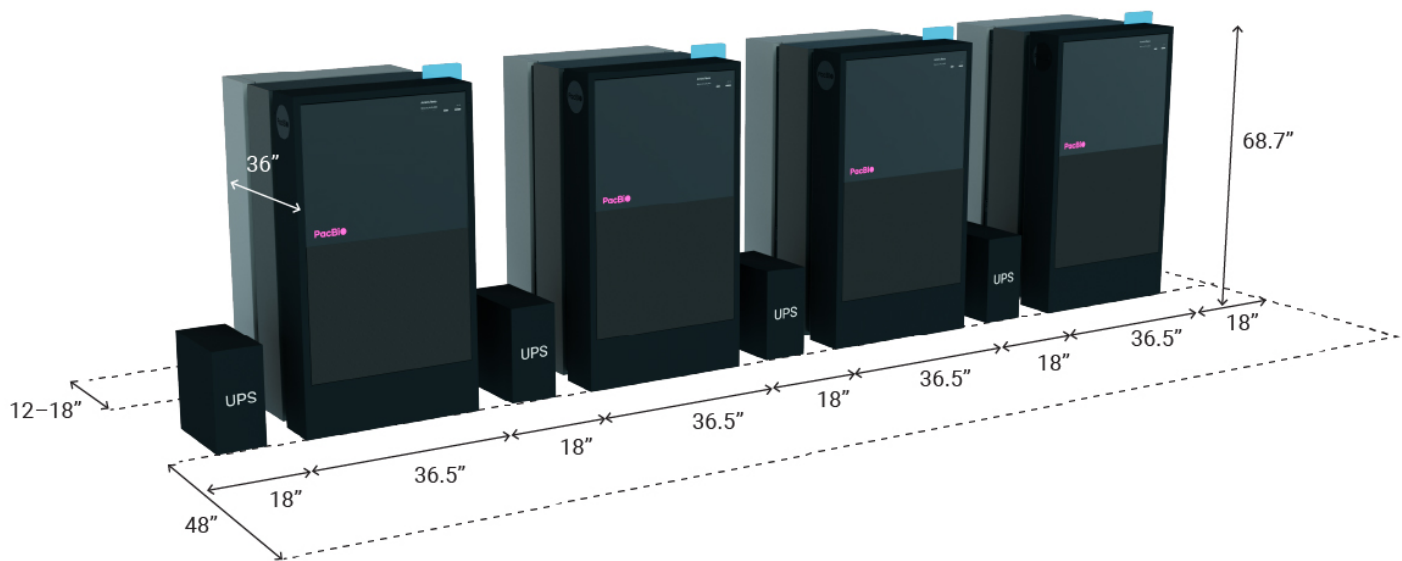
Description	Dimensions (W x D x H)	Weight	Clearances needed
Instrument and cover	36.5 x 36 x 68.7 in 92.7 x 91.4 x 174.5 cm	1025 lbs 465 kg	Left and right: 18 in (45.7 cm) Front: 48 in (121.9 cm) Back: 12 in (30.4 cm); 18 in (45.7 cm) preferred

## General layout of the instrument

Note that the room floor must be level throughout the entire area where the instrument is being installed (including the additional spaces shown in the figure below). See the Checklist for more information and other specific requirements for transporting the instrument to the designated room



## Multiple instrument placement



The general layout for multiple instruments is shown above. Note that up to 18" of open space is preferred behind the instrument, however, this can be reduced to 12" based on site-specific needs and limitations.

## Floor load

The Revo system has an estimated weight of 1025 lbs (465 kg) and the estimated area is 9.00 square feet (0.84 square meters). The floor where the Revo system will be installed must support  $>5.42 \text{ kN/m}^2$ .

## Seismic restraints

Due to high seismic activity in certain areas, local regulations may require seismic restraints for heavy equipment. Check your local regulations to determine if you need seismic restraints. If so, notify your Service Engineer during the Site Preparation process.

PacBio will provide a Seismic Restraint template (see Appendix) which provides details and locations of where hardware must be installed in the floor prior to instrument arrival (and the associated requirements and constraints). Upon request, the Service Engineer can also order seismic brackets for use during installation.

Note that it is your responsibility to provide and install the floor anchors per the template instructions prior to delivery of the instrument. It is also your responsibility to insure that the brackets' floor anchors and floor designs comply with local regulations.

## Other considerations for instrument placement

Note that the noise output of the instrument is  $<75 \text{ dB}$  at 3.3 m (10 ft 10 in) from the instrument. This should be taken into consideration when choosing instrument location and placement in your facility.

# Environmental requirements

## Maximum elevation requirement

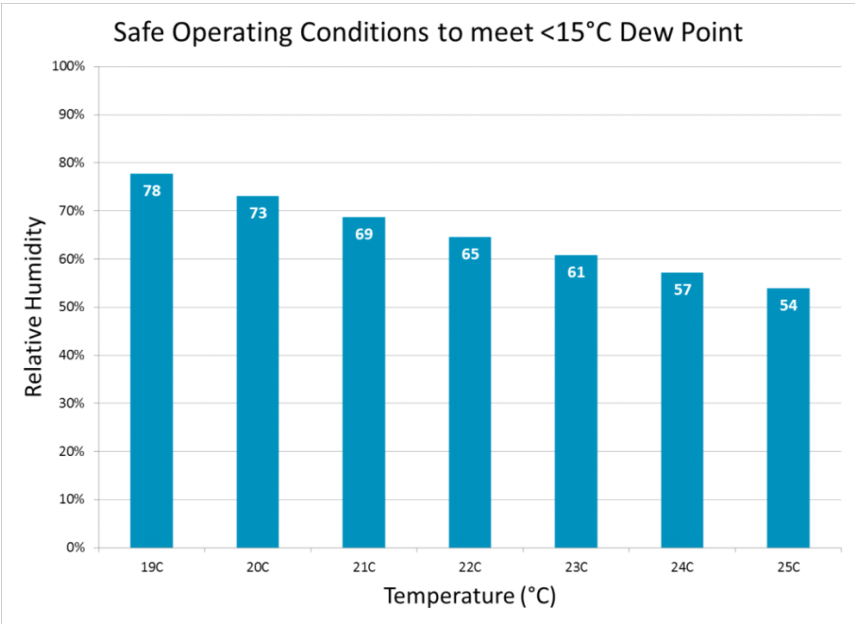
The maximum elevation for a Revio installation is 2250 m (~7400 feet). Installations will not be performed by PacBio at higher elevations.

## Temperature requirements

The room temperature must be between 19°C – 25°C (66°F – 77°F) at all times (and a maximum temperature fluctuation of 2°C per hour).

The instrument produces a maximum of 13,000 BTU (3,800 Watts) of heat. Note that using an Uninterruptible Power Supply (UPS) will generate more heat, depending on the UPS model used, so the total thermal load of the system will be higher with a UPS.

### Maximum Allowable Percent Humidity (by Temperature)



For safe operation of the Revio systems, the room must maintain a dew point of < 15°C (59°F). Note that the peak air flow from the instrument is 2000 cubic feet per minute (CFM).

### Minimum Allowable Percent Humidity

Note that the minimum operating humidity must not fall below 20%. Sequencing performance can degrade at lower humidity.

## Environmental cleanliness requirements

While a clean room environment is not required, cleanliness and absence of excessive heat and dust are important considerations for the instrument location. Clean environments help reduce the possibility of equipment failure caused by heat and dust build up.

## Air quality requirements

The instrument is designed to be operated in a Pollution Degree II environment or better. A Pollution Degree II environment is defined as one which normally includes only non-conductive pollutants.

# Electrical requirements

## Disconnecting power

In case of an emergency, immediately disconnect the power cord to the instrument. The instrument must be positioned in accordance with the requirements of this document to ensure immediate access to disconnecting the power.

## External ground connection

A 6 m long 6AWG (or 16 mm<sup>2</sup>) Green/Yellow external grounding cable terminated with a 1/4" lug is supplied for the instrument. You must supply a 6 mm (1/4") grounding stud that is compliant with local electrical codes.

The grounding cable will be fastened to the M6 Ground Stud on the back of the Electronics Chassis (near the Power Inlet connection) and run to the Building Power Earth Ground connection. See picture below for the required M6 bolt ring connector (1/4" hole) for fastening the external ground wires to the Ground Stud.

Optionally, a ground wire can be made available to terminate at the instrument.

Note that this 30 AMP ground is redundant in case of an internal short or leakage current. If the power plug is disconnected there may be a large amount of DC energy stored in the capacitors and the DC power supply internal to the instrument.

## Electrical components and requirements

The system can accept operating voltages between 200 VAC and 240 VAC. Note that under Full Load, the system draws up to 24 AMPS. Refer to the Checklist for the rated instrument voltage, frequency, and power (Watts).

Verify that your power supply meets System electrical requirements and perform any required power supply upgrades or changes before our Service Engineer arrives to install the instrument.

Note that if the electrical work is not complete prior to instrument arrival, this will cause a delay in your system install.

## Power connectors, plugs, receptacles, and cables

The requirements for the plug, power cord, and the maximum loads allowable on a branch circuit (for cord and plug utilization equipment) vary on a country-to-country basis. Install the System in accordance with all applicable codes for the System voltage configuration and installation location. See below for an image of the rear of the instrument for the ground and power supply inputs.

During installation, the power cord provided with the instrument will be configured by your PacBio Service Engineer with either a NEMA L6-30P or IEC 60309, 30A, 6H, 2P male connector. Since the combined UPS and Revio instrument current does not exceed 24A, we recommend using a 30A rated circuit breaker and power outlet. Note that you must provide a receptacle appropriate for one of these two plug types (see figures below). You must also obtain an adapter that is compliant with local electrical codes.

Component	Length of Cable	Type	Receptacle
Main instrument power cable	15 ft 4.5 m	L6-30P	L6-30R
Ground Cable	25 ft 7.6 m	1/4" Lug	6 mm (1/4") Ground Stud

## Uninterruptible Power Supply (UPS)

You are responsible for providing continuous power to the instrument. An individual UPS is recommended for the instrument if building-wide continuous power is not available.

The UPS must have a capacity of 4.8 kW or greater. It is highly recommended that a back-up battery pack for the UPS also be purchased in the event of a power failure (especially if the building power generator takes longer than 5 minutes to start). The number of battery packs needed depends on the amount of time it typically takes for the building's power generators to start. For calculating battery needs, assume a 4 kW load from the instrument.

For North America sites, an appropriate UPS pre-configured with an L6-30P connector can be purchased from APC / Schneider Electric (PN SRT5KXLTUS). Note that older UPS units produced under that part number do not have adequate capacity; it must have 4.8 kW capacity. New units under that part number are expected to have 4.8 kW capacity. In the Asia-Pacific region, the Schneider Electric SRT5GKXLI is an appropriate option.

For all international sites, contact a local UPS supplier. Be sure to also obtain the correct cables and connectors.

Note that for North America installations, no specific modifications need to be made to connect the UPS to a power source (as long as the appropriate receptacle has been provided). For other countries, see the UPS manufacturer's instructions and have a licensed electrician perform the hard-wiring to a power source.

Order your UPS as soon as you have placed an order for your instrument. The UPS should be purchased and installed before PacBio personnel arrive to install your Revo system. Since the UPS is a Customer Supplied Product, the PacBio Warranty and Service Contract do not cover the UPS.

Installation must comply with local electrical code and be performed by a licensed electrician.

## Network and compute requirements

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### Instrument connectivity and networking

An active, tested LAN connection must be in place before the scheduled installation date. The following are requirements for instrument connectivity on your network.

#### Instrument connection to your network

- 1GbE link speed required (10 GbE recommended) between instrument and storage server or network
- One static or DHCP IP address, with subnet mask and gateway for static
- For PacBio Insight (remote support) customers, outbound port 22/tcp, 80/tcp, and 443/tcp should be opened to region specific SecureLink servers detailed below.
- Domain Name System (DNS) default search domain (optional)
- DNS server addresses (optional)
- Network Time Protocol (NTP) server addresses (optional)

## Remote support with PacBio Insight

PacBio Insight enables PacBio service and support to remotely monitor and service instruments per your request. In order to enable PacBio Insight, the IT/Network administrator must open Port 22, 80, or 443/TCP outbound from the Revo system to the following SecureLink servers:

Instance	Servers	Ports Required
US	securelink-us.pacificbiosciences.com securelink-us-001.pacificbiosciences.com 34.228.163.151 securelink-us-002.pacificbiosciences.com 18.207.27.182	22, 80, or 443/TCP
EMEA	securelink-emea.pacificbiosciences.com securelink-emea-001.pacificbiosciences.com 3.122.45.57 securelink-emea-002.pacificbiosciences.com 3.121.132.217	22, 80, or 443/TCP
APAC	securelink-apac.pacificbiosciences.com securelink-apac-001.pacificbiosciences.com 3.0.254.58 securelink-apac-002.pacificbiosciences.com 13.251.34.130	22, 80, or 443/TCP

Note that PacBio Insight is customer-configurable for access and control restrictions. Please contact PacBio for details.

## Sequencing data storage

All Revo systems require customer-provided local or cloud storage for sequencing data at installation. Direct-to-cloud data transfer is supported for: Amazon S3, Google Cloud Storage, and Microsoft Azure Blob Storage. The amount of storage required for sequencing data is dependent on system utilization.

### Storage requirements

Sequencing data (assuming approximately 60GB of HiFi data per SMRT Cell and utilization at 1,300 SMRT Cells per year) is up to 78TB/year.

## SMRT Link server installation

SMRT Link is the PacBio software required for instrument management, sequencing run setup, and sequencing run quality control. It can optionally be configured to run select analyses. SMRT Link is available for a local compute environment on customer-provided hardware or as PacBio-hosted SMRT Link Cloud.

Compute requirements, networking configuration, and software features are different for a local SMRT Link server or SMRT Link Cloud. See the corresponding information and requirements, for each installation type, available in this document, the SMRT Link installation guide (v25.1+), and SMRT Link Cloud guide.

Refer to <https://www.pacb.com/support/software-downloads/> for the latest SMRT Link software download and documentation.

## SMRT Link and SMRT Link Cloud features

Your analysis needs and compute resources will inform which SMRT Link option is the best fit. To learn more about analysis features, visit <https://pacb.com/smrt-link/> or refer to the SMRT Link user guide at <https://www.pacb.com/support/software-downloads/>.

	SMRT Link	SMRT Link Lite	SMRT Link Cloud
Instrument management	Y	Y	Y
Run setup and QC	Y	Y	Y
Push-button analysis (SMRT Analysis)	Y	N	N
3 <sup>rd</sup> party and PacBio Compatible Partner analysis	Y	Y	Y
API access	Y	Y	Y

## SMRT Link and SMRT Link Lite configuration

A SMRT Link server is locally hosted on customer-provided hardware and includes support for SMRT Analysis (PacBio analysis workflows) if configured with the required hardware (see SMRT Link requirements). SMRT Link Lite, is a lightweight local installation of SMRT Link and only includes instrument management, run setup, and run QC.

### SMRT Link requirements

#### Software prerequisites: Server operating systems

- SMRT Link server software is supported on English-language Rocky Linux 9 and 10 and Ubuntu 22.04 and 24.0. This also applies to SMRT Link compute nodes.
- SMRT Link is not guaranteed to work on operating system versions which are no longer supported by their vendors.
- SMRT Link server software cannot be installed on Mac OS or Windows systems.
- Configuring your SMRT Link server with the Job Management System (JMS) is recommended. SLURM is supported. PBS and LSF can be used, but are not officially supported and will require additional configuration.

#### Software/Hardware prerequisites: Client operating systems/Web browser

To use SMRT Link on a client operating system:

- SMRT Link requires the Google Chrome web browser, version 83 or later.
- SMRT Link requires a minimum screen resolution of 1600 by 900 pixels.

## SMRT Link server configuration requirements

Component	SMRT Link multi-node		SMRT Link single node	SMRT Link Lite
	Head node	HPC node		
CPUs	8 cores	64 cores	16 cores/32 threads	4 cores
RAM	32 GB	4 GB per core	64 GB	16 GB
Local storage	500 GB SSD	100 GB SSD or HDD	1 TB SSD	50 GB SSD

SMRT Link servers configured with an HPC node are required to support running Variant Calling analysis and larger Iso-Seq® Analysis jobs (>20M reads).

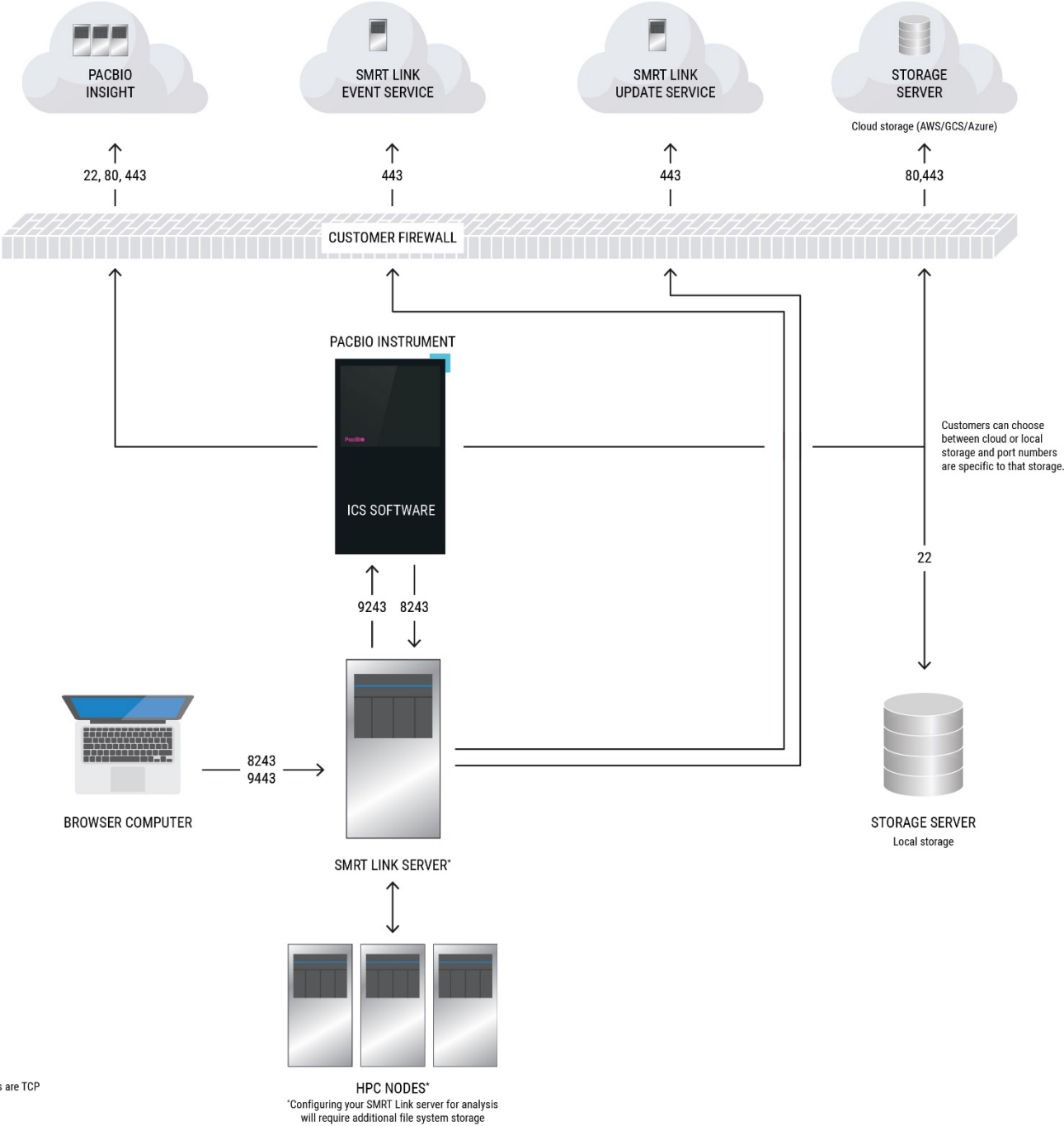
### Analysis data storage

A local and full SMRT Link installation includes SMRT Analysis which offers push-button analyses for select utilities and applications. To learn more about analysis features, visit <https://pacb.com/smart-link/> or refer to the SMRT Link user guide at <https://www.pacb.com/support/software-downloads/>.

Analysis data storage must be a shared file system and networked with both the SMRT Link server and any HPC nodes. Storage of files produced by SMRT Analysis will approximately double the per SMRT Cell storage requirement. The amount of analysis storage required will depend on your utilization and analyses used.

### Revio and SMRT Link, including SMRT Link Lite, network diagram

INTERNET



## Ports and firewalls

The graphical web interface for locally-hosted SMRT Link requires that web browsers can access the HTTPS port 8243, which serves up the password-protected services API and static web content. This port is also used by the Revio system. Therefore, it needs to be available to any Revio instrument as well. Similarly, there is return communication from the SMRT Link server to the Revio system on HTTPS port 9243.

- If your network is already configured to leave these ports open, no additional changes are required.
- If you have restricted access to port 8243 to localhost (meaning the GUI can only be viewed in a browser running on the SMRT Link server itself) or specific remote hosts, exceptions allowing the Revio instrument(s) to communicate with port 8243 on the SMRT Link server are required.
- If you have restricted access to port 9243 to localhost, exceptions allowing the SMRT Link server to communicate with port 9243 on the Revio instrument(s) are required.

## SMRT Link update service

The **SMRT Link Update Service** will provide automatic notification and installation of available updates to components of the current version of SMRT Link software.

The network destination <http://smrtlink-update.pacbcloud.com:8084> must be allowed to enable this service.

## SMRT Link event service

The SMRT Link Event Service can be used to send information to the PacBio Technical Support Team to troubleshoot installation and analysis failures.

## Revio system and SMRT Link, or SMRT Link Lite, network ports and protocols

Source	Destination	Port/Protocol	Description
Revio system	SecureLink Servers	22/tcp, 80/tcp, or 443/tcp	Communication for remote support (PacBio Insight)
Revio system	Storage (Cloud or local)	SSH: 22/tcp or Cloud: 80/tcp and 443/tcp depending on protocol	Data transfer from instrument to customer storage
Revio system	Customer or external NTP servers	123/udp	Used for updating machine time. Defaults to pool.ntp.org
Revio system	Customer server	53/udp or 53/tcp	Nameservers
Revio system	SMRT Link server	8243/tcp	Communication from instrument to SMRT Link
SMRT Link server	Revio system	9243/tcp	Communication from SMRT Link to instrument
Customer laptop/desktop PC	SMRT Link server	8243/tcp	SMRT Link web services and GUI https
Customer laptop/desktop PC	SMRT Link server	9443/tcp	Optional SMRT Link Administration https (API Management Interface)
SMRT Link server	Shared Network File System (NFS) <sup>a</sup>	NFS ports (may vary depending on configuration)	Shared file system (NFS) storage for analysis data
SMRT Link server	PacBio Event server ( <a href="https://smrtlink-eve.pacbcloud.com:443">https://smrtlink-eve.pacbcloud.com:443</a> )	443/tcp	Optional reporting of server metrics to PacBio Tech Support
SMRT Link server	PacBio Update server ( <a href="https://smrtlink-update.pacbcloud.com:8084">https://smrtlink-update.pacbcloud.com:8084</a> )	8084/tcp	Downloading Chemistry Updates
HPC nodes	Shared Network File System (NFS) storage <sup>a</sup>	NFS ports (may vary depending on configuration)	Shared file system (NFS) storage for analysis data

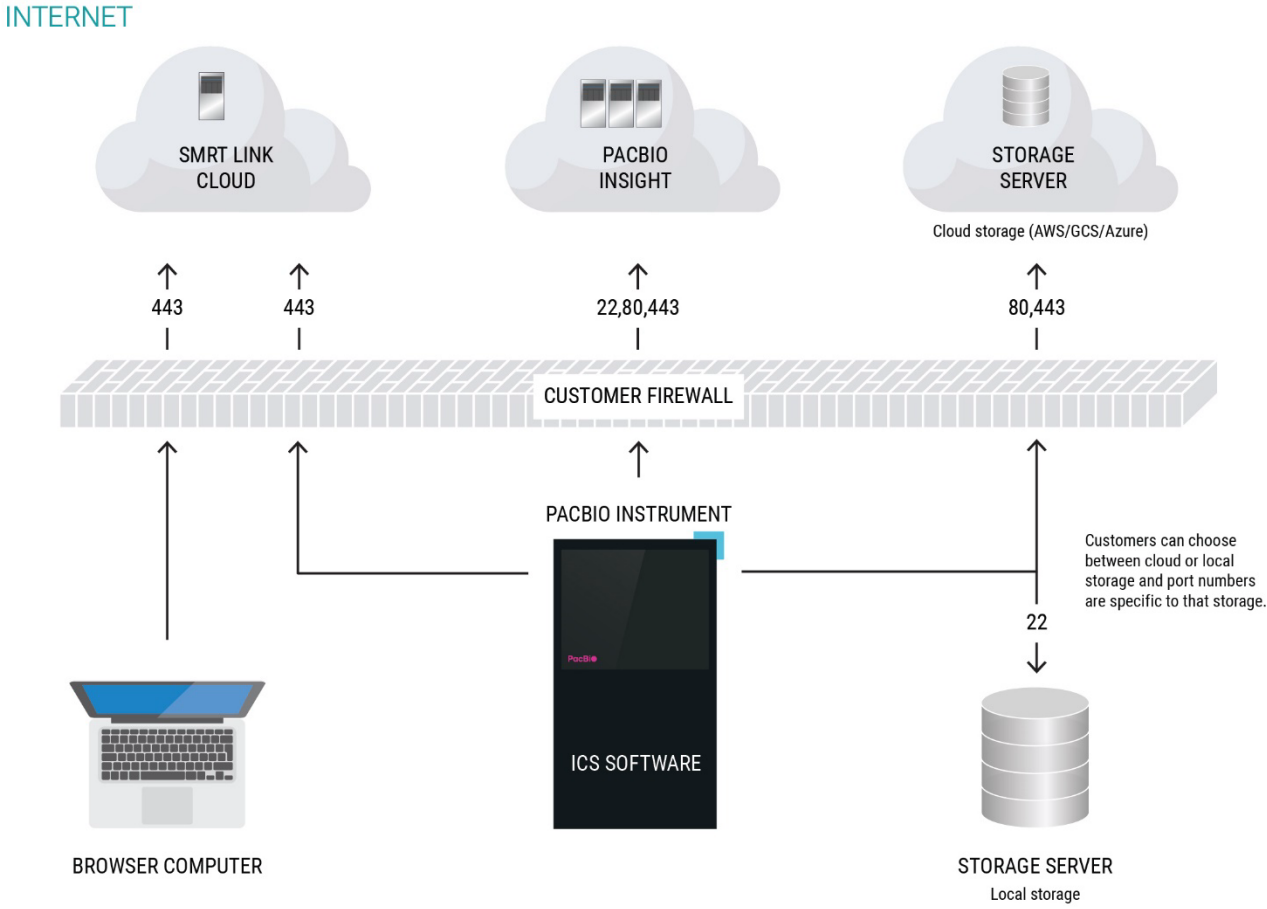
### a. Network file system requirements

- If used, NFS mounts to the input and output locations.
- HPC compute nodes must be able to write back to the NFS.
- Additional file system storage may be required if using SMRT Link for analysis. This approximately doubles the storage requirement.

### SMRT Link Cloud configuration

SMRT Link Cloud is a PacBio hosted SMRT Link service. Its features include instrument management, run setup, and run QC. Refer to <https://www.pacb.com/support/software-downloads/> for the latest SMRT Link software documentation.

### Revio and SMRT Link Cloud network diagram



**Ports and firewalls**

SMRT Link Cloud communicates on port 443 for both GUI and API users. The IT/Network administrator must open port 443/TCP outbound from the instrument to the following servers:

- [iot.pacificbiosciences.com](https://iot.pacificbiosciences.com)
- [iot-smrtlink.pacificbiosciences.com](https://iot-smrtlink.pacificbiosciences.com)
- [pacbio.okta.com](https://pacbio.okta.com) (only required during instrument configuration)

SMRT Link Cloud is not compatible with IP based firewall rules. For robustness and scalability, AWS IP addresses change over time. Some firewall appliances using IP caching may block access if they store outdated IP information or can't refresh DNS lookups. Consult your IT administrator for details on your network setup.

**Revio system and SMRT Link Cloud network ports and protocols.**

Source	Destination	Port/Protocol	Description
Revio system	SecureLink Servers	22/tcp, 80/tcp, 443/tcp	Communication for remote support (PacBio Insight)
Revio system	Storage (cloud or local)	SSH: 22/tcp, or Cloud: 80/tcp and 443/tcp depending on protocol	Data transfer from instrument to customer storage
Revio system	Customer or external NTP servers	123/udp	Used for updating machine time. Defaults to pool.ntp.org
Revio system	Customer server	53/udp or 53/tcp	Nameservers
Revio system	SMRT Link Cloud	443/tcp	Communication from instrument to SMRT Link
Customer laptop/desktop PC and ICC	SMRT Link Cloud	443/tcp	SMRT Link web services and GUI https

# Limited product warranty

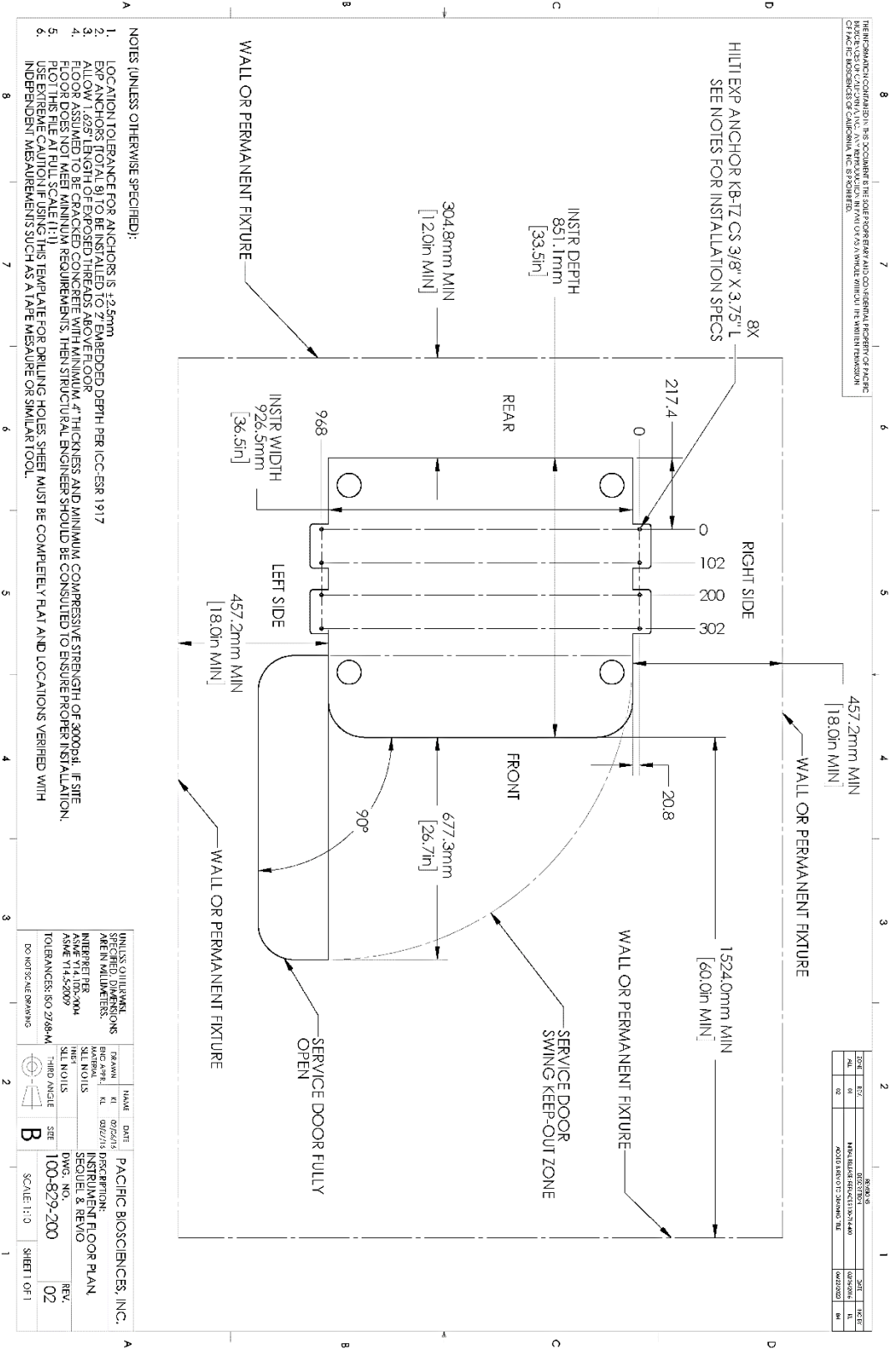
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# Technical assistance

For technical assistance, contact Technical Support. Email: [support@pacb.com](mailto:support@pacb.com) Telephone: 1-877-920-PACB (7222).



# Appendix



Revision history (description)	Version	Date
Initial release	01	February 2023
Added air flow information and updated network diagram. Added seismic bracket drawing and instrument floor plan to appendix.	02	September 2023
Added noise output for instrument placement considerations.	03	May 2024
Updates to compute and network requirements section	04	November 2024
Removed rotator under required equipment	05	August 2025
Updates to SMRT Link server configuration table format and SMRT Link Cloud requirements in network and compute requirements section.	06	December 2025
Minor typo correction	07	January 2026

