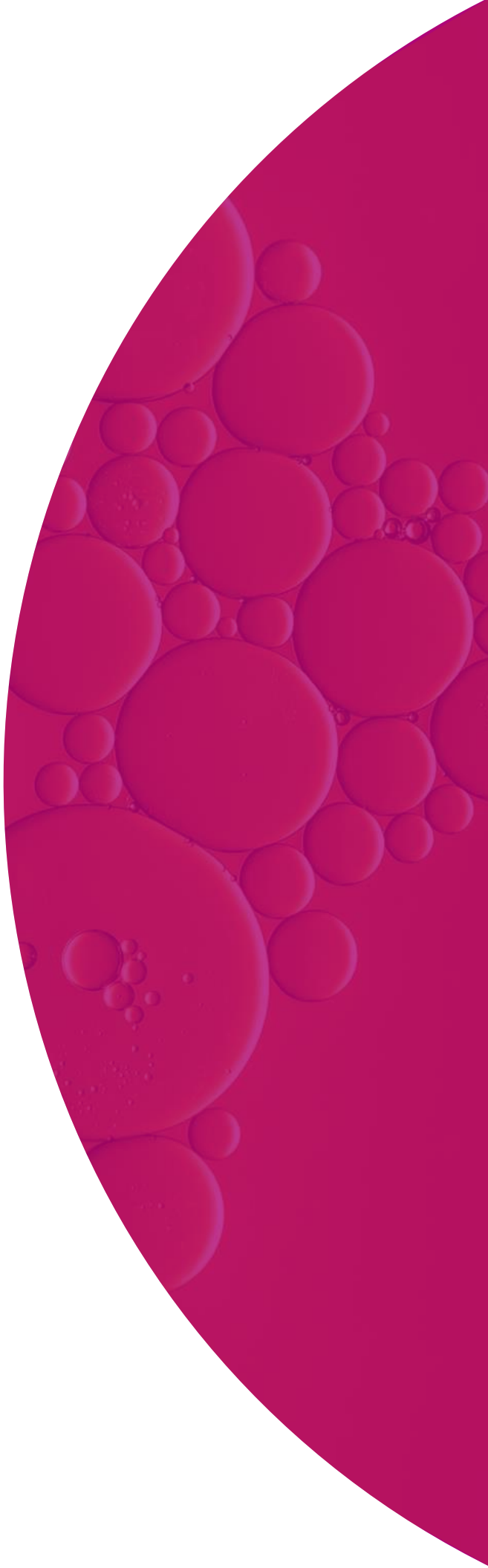
PacBio

Revio™ system

Site preparation guide



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Introduction

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 the customer 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

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.

Caution: Only authorized personnel can uncrate, install, or move the instrument and other system devices.

Caution: **ELECTRICAL SHOCK AND LASER HAZARD** Installation, maintenance and repair are only allowed for authorized service personnel. Do not remove the panels of the Revio systems.

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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 125.7 x 115.3 x 220.4 cm	365 lbs 166 kg	1,400 lbs 635 kg

Equiment 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	MLS
Molecular Biology Grade H_2O	1	MLS
Isopropyl Alcohol (70%-99%)	1	MLS
Rotator	1	VWR PN 13916-822 / 13916-824 / 13916-828 / 13916-826

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.

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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

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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.

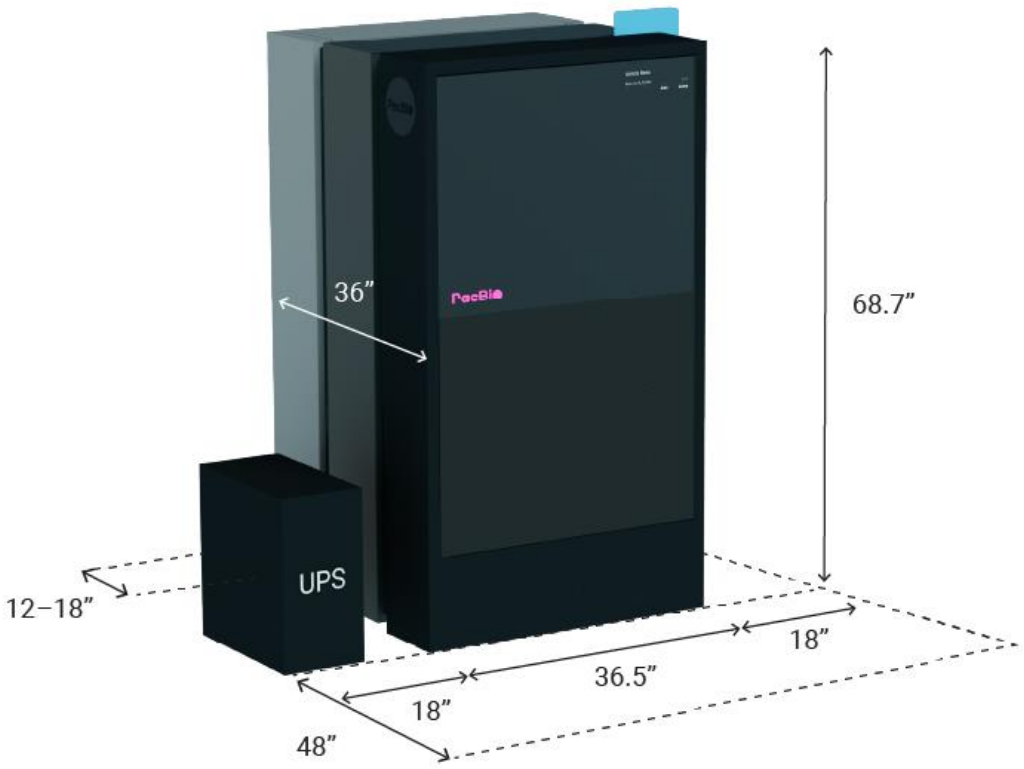
Important: PacBio Service Engineers will come to your site to uncrate the instrument and move it to the installation location. Please do not attempt to uncrate the instrument.

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 kb	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



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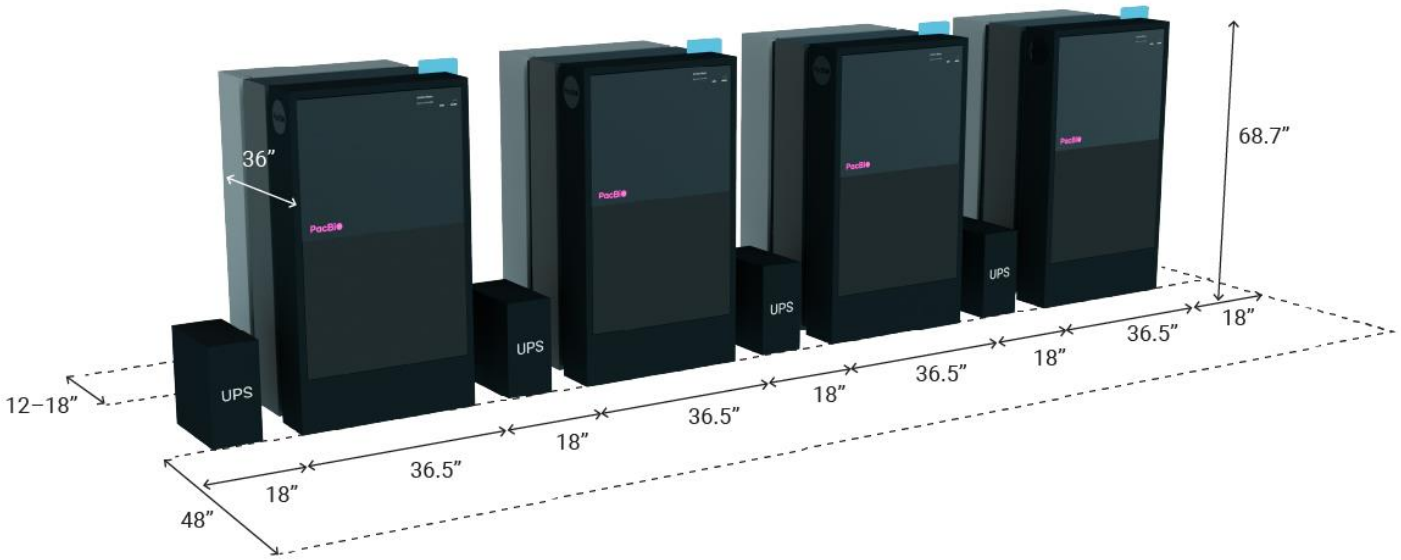
Multiple instrument placement



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 Revio 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 Revio system will be installed must support >5.42 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 the customer’s responsibility to provide and install the floor anchors per the template instructions prior to delivery of the instrument. It is also the customer’s 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 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.

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Environmental requirements

Maximum elevation requirement

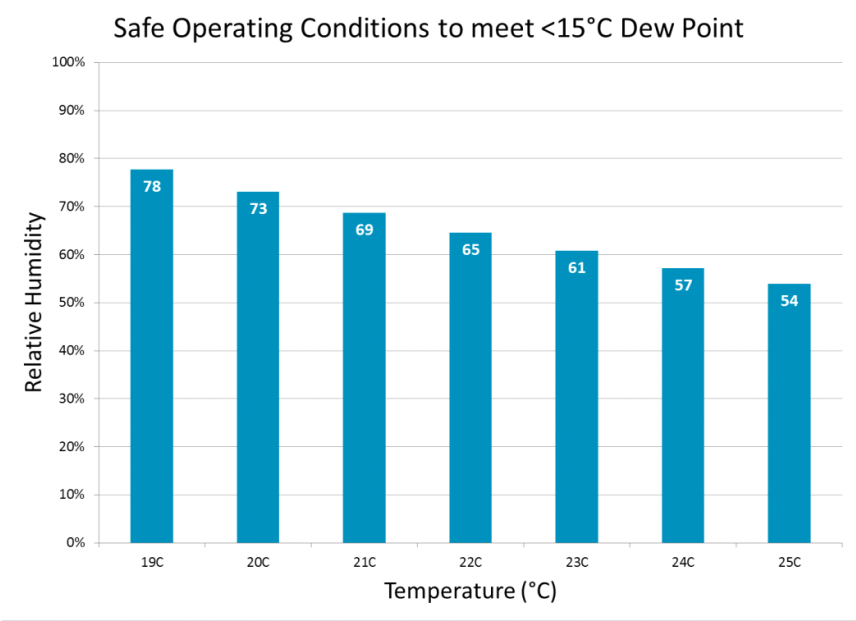
The maximum elevation for a Revio installation is 2250 m (~7400 feet). Installations will not be performed by PacBio at higher elevations.

Temperature requirements

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

The instrument dissipates a maximum of 13,000 BTU (3,800 Watts) of heat. Note the use of an Uninterruptible Power Supply (UPS) will add more to the heat load, depending on the UPS model used, so the total system usage will be higher than this number with a UPS.

Maximum Allowable Percent Humidity (by Temperature)



For safe operation of the Revio systems, the room must maintain a dew point of < 15ºC (59ºF). 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%. Sample performance and read length can degrade if the correct humidity is not maintained.

Environmental cleanliness requirements

While a clean room environment is not required, cleanliness and lack 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.

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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 mm2) 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 image of rear of 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

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Uninterruptible power supply (UPS)

The customer is 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 Revio 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 requirements

SMRT Link installation

Either a local compute environment or AWS can be used to install SMRT Link. See the corresponding information and requirements, for each installation type, available in this document and the SMRT Link Software Installation (v12.0+) instructions. Refer to https://www.pacb.com/support/software-downloads/ for the software download and documentation.

Instrument connectivity

An active, tested LAN connection must be in place before the scheduled installation date.

Instrument connection to customer's network

The following are requirements for instrument connectivity to the customer's network:

- 1GbE link speed required (10 GbE recommended) between instrument and storage server
- 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 securelink.com
- Domain Name System (DNS) default search domain (optional)
- DNS server addresses (optional)
- Network Time Protocol (NTP) server addresses (optional)

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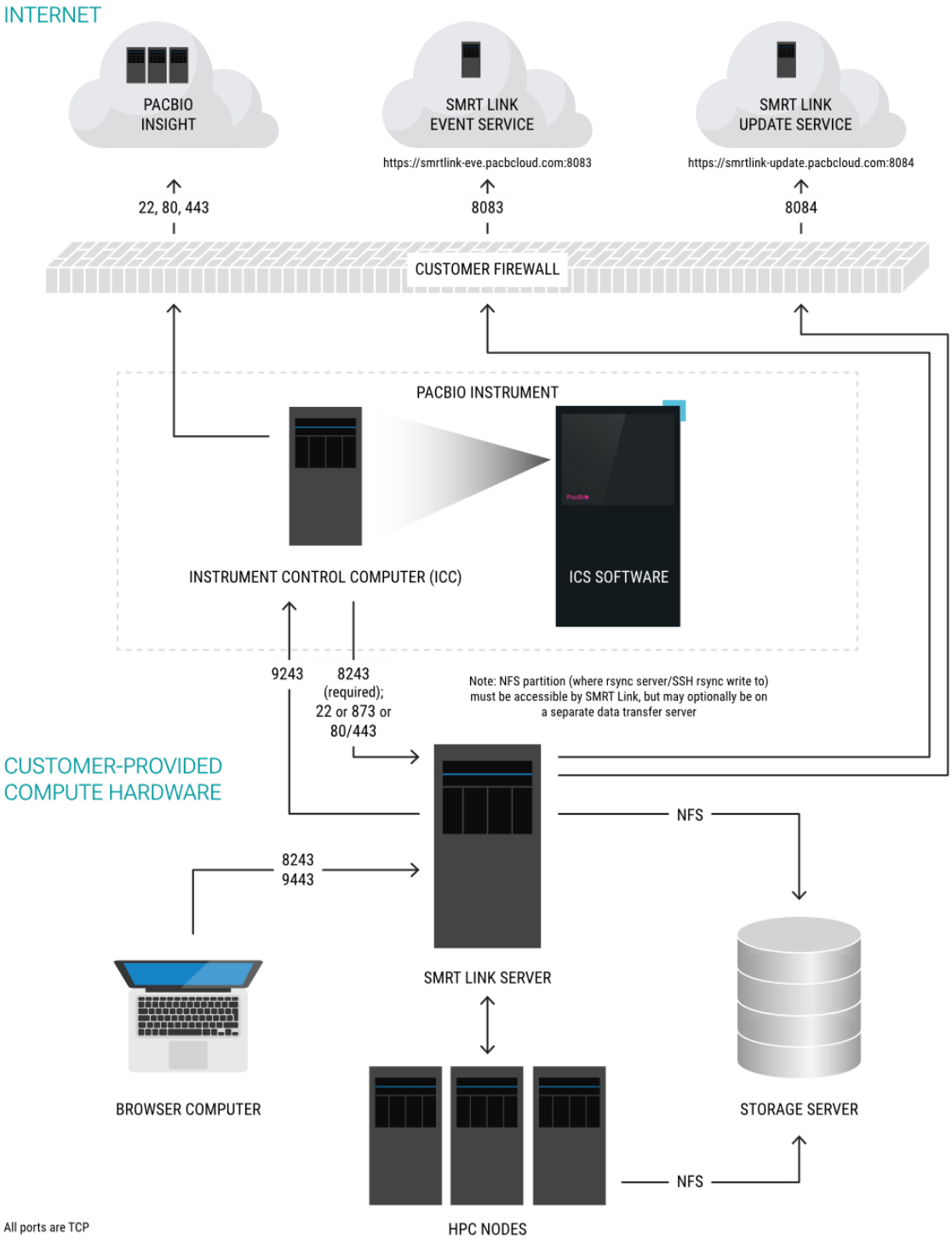
PacBio Revio network diagram

Recommended configuration: SMRT Link server is the same as the data storage server.



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Network file system requirement

- NFS mounts to the input and output locations.
- Compute nodes must be able to write back to the job directory.

Source	Destination	Port/Protocol	Description
Revio Instrument Control Computer (ICC)	SecureLink Servers	443/tcp	Communication for remote support (PacBio Insight)
ICC	Data Transfer Server	22/tcp, 873/ tcp, or 80/tcp and 443/tcp depending on protocol	Data transfer from instrument to customer storage
ICC	Customer or external NTP servers	123/udp	Used for updating machine time. Defaults to pool.ntp.org
ICC	Customer server	53/udp or 53/tcp	Nameservers
ICC	SMRT Link server	8243/tcp	Communication from instrument to SMRT Link
SMRT Link server	ICC	9243/tcp	Communication from SMRT Link to instrument
Customer laptop/ desktop PC	SMRT Link server	9090/tcp	SMRT Link GUI http
Customer laptop/ desktop PC and ICC	SMRT Link server	8243/tcp	SMRT Link web services and GUI https
Customer laptop/ desktop PC	SMRT Link server	9443/tcp	SMRT Link Administration https (API Management Interface)
SMRT Link server	Shared Network File System (NFS) storage	NFS ports (may vary depending on configuration)	NFS shared storage access shared data to analyze
SMRT Link server	PacBio Event server (https://smrtlink-eve.pacbcloud.com:8083)	8083/tcp	Optional reporting of server metrics to PacBio Tech Support
SMRT Link server	PacBio Update server (https://smrtlink-update.pacbcloud.com:8084)	8084/tcp	Downloading Chemistry Updates
HPC nodes	Shared NFS storage	NFS ports 2049/ tcp (ports vary depending on configuration)	NFS shared storage access shared data to analyze

Ports and firewalls

The SMRT Link GUI 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 Instrument Control Software (ICS). 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 Instrument Control Software (ICS) 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 being 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.

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SMRT Link requirements

Software prerequisites: Server operating systems

- SMRT Link server software is supported on English-language CentOS 7.x and 8.x, and Ubuntu 20.04 and 22.04 64-bit Linux distributions. (This also applies to SMRT Link compute nodes.)
- SMRT Link is not guaranteed to work on LINUX versions which are no longer supported by the Operating Systems' vendors.
- SMRT Link server software cannot be installed on Mac OS or Windows systems.

To use SMRT Link on AWS, contact PacBio Technical Support for implementation and further guidance.

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.

Computer requirements table

SMRT Link	
Total cores	16
Total RAM	64 GB
Local storage	1 TB
HPC system	
Minimum cores (total)	64
Minimum RAM per core	4 GB
Minimum local storage (HDD or SSD)	100 GB (500 GB preferred to support future workflows)
Recommended HPC nodes by Application	
Human genome	2 nodes
Single-cell transcriptome	2 nodes
Large gene panels	1 node
Shared data storage	
Sequencing data	72 TB / Revio / Year
Network speed	
1 GbE or 10 GbE, copper	

Application-specific refinements of these requirements may be made available in the future.

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Remote support with PacBio Insight

In order to enable PacBio Insight, the IT/Network administrator must open Port 22, 80, 443/TCP outbound to the following SecureLink servers:

- securelink-us.pacificbiosciences.com
- securelink-us-001.pacificbiosciences.com 34.228.163.151
- securelink-us-002.pacificbiosciences.com 18.207.27.182
- securelink-emea.pacificbiosciences.com
- securelink-emea-001.pacificbiosciences.com 3.122.45.57
- securelink-emea-002.pacificbiosciences.com 3.121.132.217
- securelink-apac.pacificbiosciences.com
- securelink-apac-001.pacificbiosciences.com 3.0.254.58
- securelink-apac-002.pacificbiosciences.com 13.251.34.130
- instrument-eve.pacbcloud.com 13.52.21.162

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

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.

The network destination https://smrtlink-eve.pacbcloud.com:8083 must be allowed to enable this service.

Printer recommendations

The system can use a network or dedicated printer. If using a printer, the printer and any necessary print drivers must be available before the scheduled installation.

Limited product warranty

PacBio and/or its affiliate(s) warrant their products as set forth in the PacBio General Terms and Conditions of Sale. If you have any questions, please contact PacBio at support@pacb.com.

Technical assistance

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

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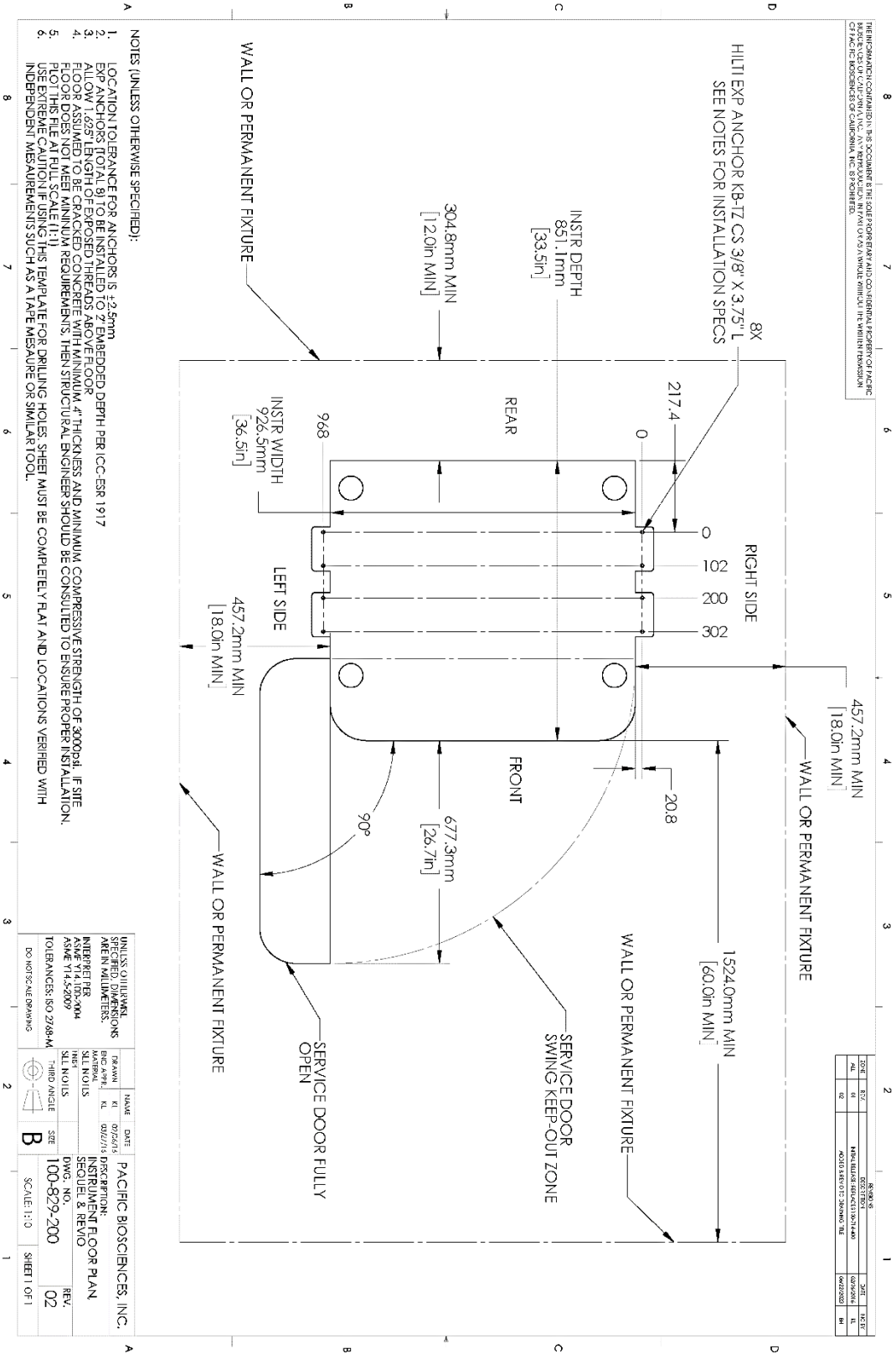
Appendix



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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

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