STS-1020

On-Board Installation Guide

LILEE SYSTEMS

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Name: STS-1020 On-Board Installation Guide

Part: STS-UG-2004101002

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Contents

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Pre-Installation

This chapter includes information you should review prior to beginning installation, such as tools, materials, specifications, and mounting orientation.

About this guide

- Chapters 1 to 4 of this guide serve as an on-board installation guide, focused on physical installation requirements and procedures.

  "Pre-Installation " above
  "Power" on page 13
  "Antenna Installation" on page 25
  "Mounting the STS and Meraki Units" on page 33

- Chapters 5 to 8 of this guide provide more general reference material on the STS series hardware, including optional software configuration steps. Some installers may perform one or more of the software configuration steps, while in other cases these steps may be executed by an administrator or via LILEE Systems T-Cloud.

  "Configuration" on page 40
  "Front Panel Ports and Indicators" on page 45
  "Rear Panel Connectors and Indicators" on page 55
  "Maintenance" on page 62

- This guide focuses strongly on the STS-1020 hardware but also includes some references to similar STS-1010 hardware. If you are not using the STS-1010, you can simply ignore references to it.
- This guide uses a `monospace font` to distinguish command-line input and output from other text. This font is also used to distinguish command names and locations in the filesystem, such as `/etc/example/directory/sample-file.cfg`.
- For a complete command-line reference, see the *LileeOS Command Reference Guide*.

Package contents

Your STS package contains:

- STS chassis
- One 4-pin terminal block plug for DC-in (Phoenix Contact, Part 1912090, 4-position)
- Two 5-pin terminal blocks for digital I/O
- CR2032 lithium ion battery installed in the chassis
- Tray-mounted 2.5” 32 GB SSD (SATA0), shipped in accessory box
- Console cable (RJ-45 to DB9)
- Six M3 Phillips flat head screws, to mount optional drive at SATA1 (STS-1020)

Contact support if any of these items are damaged or missing.

Tools and materials

You will need to assemble the following tools and materials, which are not included.

Tools

- Screwdriver, Phillips, #2x4 in. round
- DC Multimeter
- 3.5mm SMA 5/16 Torque Wrench (5 in-lbs. torque driver). KCR P/N# KCR-3125S-5
- 10-25 ft. x 1 in. measuring tape
- Small scissors
- Flashlight
- Wire stripper
- Crimping Tool, Westward/Grainger #13H899 (1.5-10 mm, awg: 16-5)

Materials

- 14/3 AWG tinned marine wire, for power
- 18 or 20 AWG tinned marine wire, for optional digital I/O
- Sharpie pens and electrical tape suitable for labeling
- #10 x 5/8" or 3/4" Phillips self-tapping screws (Qty. 6 to 8)
- Zip ties (Qty. 6)
- P-clamp black 3/4 in. cable clamps (Qty. 2)
- Corrugated split loom 3/4" (5 feet)
- Double-sided tape (3 feet)
- Black electrical tape (Qty. 5)
- Inline fuses (Qty. 1)
- Ring terminals (Qty. 1)
- Butt splices (Qty. 2)

Caution: LILEE Systems requires 14/3 AWG wire when connecting power using only two pins of the 4-pin terminal block, as illustrated here. If you choose to run a 16 or 18 AWG power cable, you must connect four conductors across all four pins. Maximum power for the STS-1020 is 100 W, and maximum current is 12 A at 10 V input. Do not use gauges lighter than 18 for power.

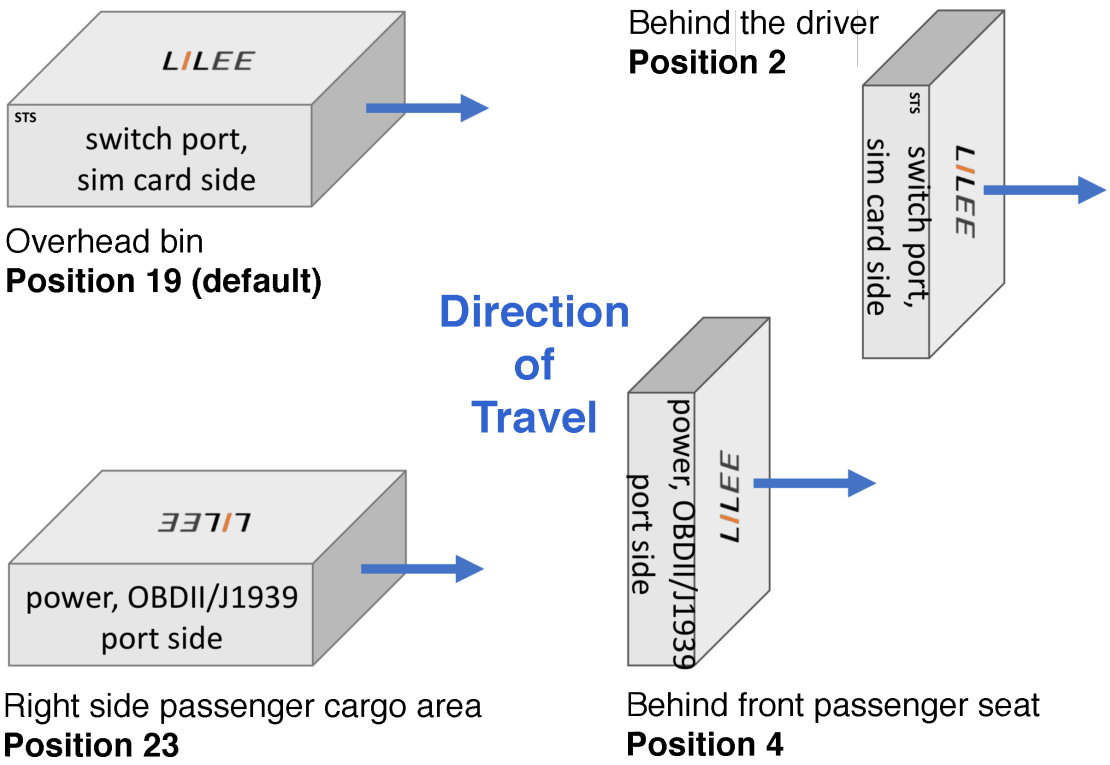
Tip: The optional 18 or 20 AWG tinned marine wire is required only for installations that use the digital I/O port for power on/off delay. Current on this wire is only 6mA, so lighter gauge is recommended.

Note: LILEE Systems recommends tinned marine wire for durability features that make it suitable for vehicles. Use other wire types at your own risk. Amount of wire required will depend on the vehicle.

Determining STS position

You can install the STS unit in the orientation necessary to accommodate your vehicle. Each position has a reference number that's determined by which face of the unit is toward the vehicle's *direction of forward travel* and which is *down*. You will need to know your position's reference number after installation, during software configuration of the unit.

Tip: The default is position 19, which is the most commonly used. All examples in this guide will assume position 19. If you are using a different position, you may need to adjust an example accordingly.



Note: Physically, this means that there are 24 possible positions. LILEE Systems tests and supports the four positions shown above, which satisfy almost all installations. If you believe your installation requires one of the orientations which is not yet officially tested and supported, please discuss with your LILEE Systems support professional.

Identifying faces of the STS unit

Face Name	Description
Front	Face that features Ethernet switch ports, status lights, SIM card slots, and STS model number at top left corner.
Top	The top is up when the front is facing you with its text upright. It is the largest face that features cooling fins.
Left	This face is to your left when the front is facing you with its text upright.
Right	This face is to your right when the front is facing you with its text upright.
Bottom	This face is down when the front is facing you with its text upright.
Back	This face features an HDMI port and six antenna posts.

STS position numbers

	Face Toward Direction of Travel:		
Face Down:	Top	Left	Right
Left	4	-	-
Right	2	-	-
Bottom	-	23	19*

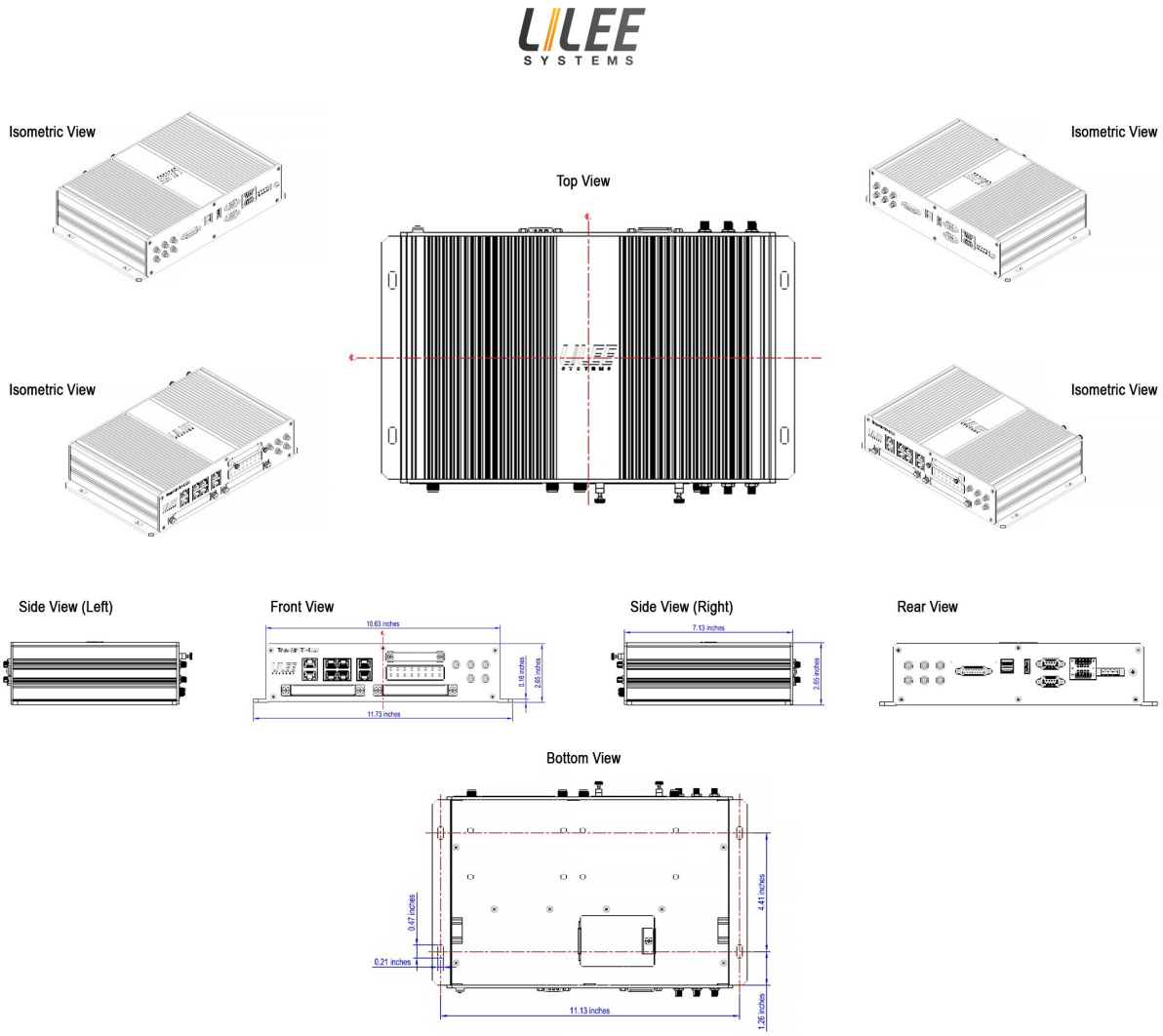
* "Standard" position and system default

Specifications

This chapter lists mechanical, operating environment, and electrical specifications for the STS platform.

Mechanical

- Weight: 6.61 lbs. (3 kg)
- Dimensions (H x W x L): 2.6 x 7.1 x 11.7 in (67 x 181 x 298 mm



Operating environment

- Functional operating temperature: -40 to 158 °F (-40 to 70 °C)
- Safe operating temperature: -40 to 122 °F (-40 to 50 °C)
- Storage temperature: -67 to 185 °F (-55 to 85 °C)
- Ambient relative humidity: 5 to 95% non-condensing

Note: If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum operating temperature.

Electrical

- Connector: 4-pin terminal block, male pin
- Input voltage: 10 to 30 VDC (2 ms minimum ramp up time is recommended)
- Consumption:
  - 4.8 W during sleep/soft off
  - 15 W at idle, no external connections
  - 100 W maximum with PoE (61.6 W max to devices)

Note: Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit.

Note: Give consideration to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Consult the equipment nameplate ratings when addressing this concern.

Radiation safety

When operating the STS, always maintain a distance of at least 60 cm away from the STS and from any Wi-Fi or cellular antennas connected to the STS to minimize your risk of radiation exposure.

2

Power

This chapter covers power wiring pre-check, connection, and configuration.

Note: Some of the images in this section depict a 2-conductor power cable, such as 12/2 AWG or 14/2 AWG. When those images were created, a separate ground wire was assumed. We now recommend using a 14/3 AWG power cable for simplicity, so that you do not need to run a separate ground wire. Images will be updated in a future version of this guide.

Choose power connection type

When connecting power to the STS-1020, the first and most important decision you must make is what type of power connection you want to use. This will affect the rest of your installation.

The STS-1020 supports both *hard power* on/off and *soft power* on/off. The advantage of using soft power off is that the STS unit has a few minutes after the engine is shut down to finish administrator uploads (video clips) and maintenance tasks. When using hard power, these maintenance and admin tasks are delayed until the next time the vehicle starts. Soft power on/off may also keep Internet service available to passengers on vehicles which stop their engines automatically at stop lights, or similar, as a fuel saving measure.

Warning: You should only choose a soft power on/off installation in vehicles whichare daily drivers with healthy batteries. This is because, in its soft power off state, the STS-1020 still consumes a minimum of 4.8 W trickle power. Failure to considerthis limitation may result in a dead battery. For questions about this feature, please contact your LILEE Systems support representative.

Warning: You should have a qualified vehicle electrician or mechanic who is familiar with the vehicle's various circuits make the final choice of connection point based on your intent. Mistakenly connecting to an *always-on* power source when you don't mean to may result in a dead battery.

Hard power on/off

A *hard power* on/off connection means that power is cut to the STS-1020 immediately when the vehicle's key is turned to *any position other than the On position*, such as Off or ACC (accessory).

- This will cause the STS-1020 to stop functioning immediately, without warning.
- The STS-1020 and its operating system are designed to withstand sudden power off.
- This is the simpler type of installation (one less wire) and is appropriate for vehicles which are not daily drivers.

To implement hard power, you must connect the STS power cable to *a circuit which is only powered when the vehicle ignition is set to the **On** position*. Aside from this determination, no other steps are required to implement hard power.

Soft power on/off

A *soft power* on/off connection means that power is still available to the STS-1020 unit for some period of time after the vehicle's ignition is set to the Off position. When the STS unit senses that the vehicle's ignition has been turned off, it starts a timer, after which it enters a soft power-off state. Like sleep, it will still draw trickle power.

- The default timer runs three to five minutes, depending on circumstances.
- This requires an additional wire and more vehicle expertise.
- This is not for occasional-use vehicles; trickle power would kill battery.
- Sensing that the vehicle is off requires true ignition signal (see below).
- Failure to use true ignition in a soft power install may kill the vehicle battery.

To implement soft power on/off, you must connect the STS power cable to *a circuit that is powered when the vehicle ignition is in the **Off** position*. This circuit might be battery, accessory, or other, depending on vehicle type. According to your preference and options offered by the vehicle, this circuit may be always-on or one which is available for only a few minutes after the ignition is turned to Off.

What is *true ignition*?

True ignition is not a protocol or standard, so don't expect to find the "true ignition" circuit in your vehicle manual. Rather, true ignition is an informal term for the practice of *identifying a circuit which is powered **only** when the vehicle's ignition is in the **On** position* and then connecting a signaling wire to that circuit.

- This must be interpreted strictly; an accessory (ACC) circuit or similar would not qualify as a true ignition circuit, nor would one that is only available when the ignition is at the **Start** position.
- On the STS-1020 unit, the true ignition signal wire connects to one of the digital I/O ports, as described later in this guide.
- A qualified vehicle electrician or mechanic should choose the circuit.

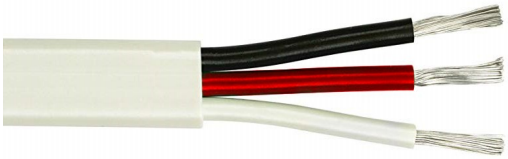
Prepare wiring

The STS-1020 uses 14/3 tinned marine wire for its power run and a single conductor of 18 or 20 AWG tinned marine wire for the optional digital I/O connection.

Power

The three conductors of the 14/3 AWG wire are intended for power (+/-) and ground (GND).

1. Cut a length of 14/3 AWG tinned marine wire that is sufficient to route from the STS location to the ultimate power and ground terminals.
2. At each end of the cable, remove enough of the sheathing to allow the wires to reach their destinations.
3. Strip approximately 0.5 cm from each wire end as shown below.



Digital I/O

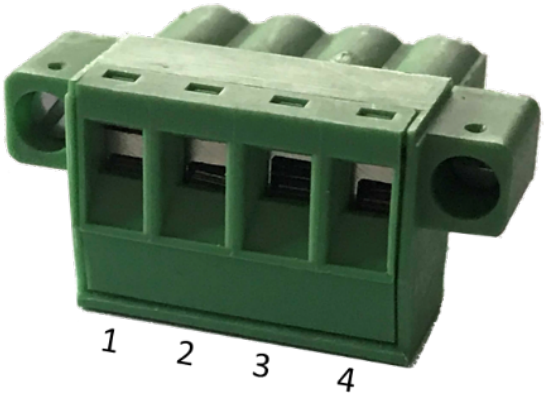
This wire is optional. You only need this if your installation will rely on a true ignition source to facilitate power on/off delay.

1. Cut a length of 18 or 20 AWG tinned marine wire that is sufficient to route from the STS location to the true ignition source.
2. Strip approximately 0.5 cm from each wire, as shown above.

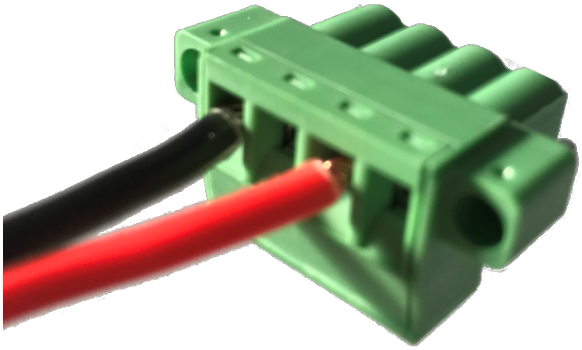
Connect the terminal blocks

Follow these steps to prepare the terminal block for power at the STS end of the power cable:

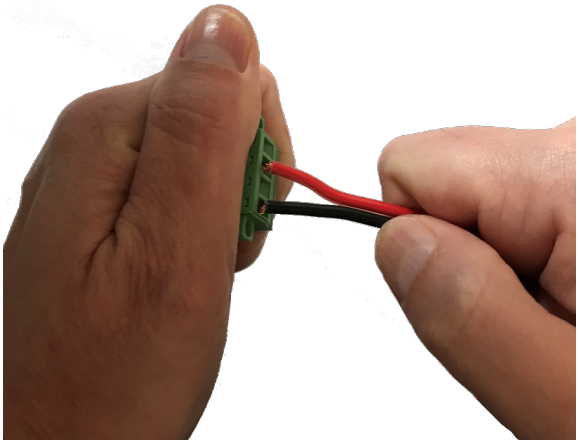
1. Locate the 4-pin terminal block in the accessory box, and loosen screws 1 and 3 at the bottom of the block.



2. At the STS end of the power cable, connect the black wire to pin 1 (-) and the red wire to pin 3 (+) of the 4-pin terminal block.

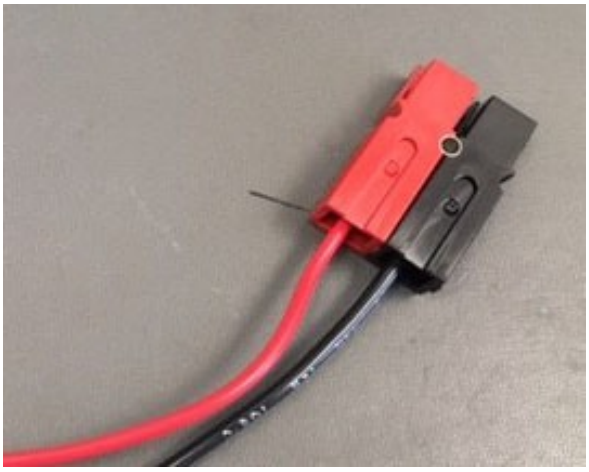


3. Tighten the set screws on bottom of the terminal block to secure the wires in place.
4. Perform a "pull-and-push" test on the red-and-black power cable to verify that the connections between the wires and the PWR terminal are securely fastened:
    - Hold the cables together in one hand, and the 4-pin terminal block in the other.
    - Pull your hands away from each other, then push them together to test the cables.
    - Repeat once or twice. They should remain secure.

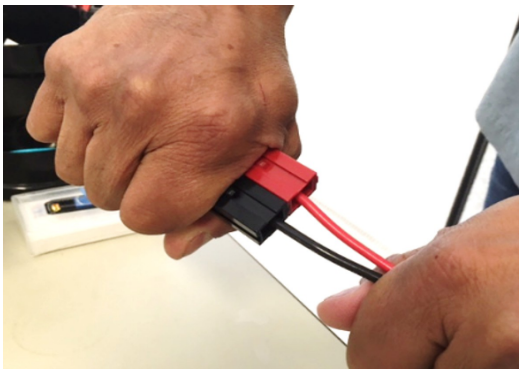


Power cable pre-check

1. Verify that the red-and-black wires of the power cable have clamps and are mounted together as shown here.



2. Power the bus on and use t he DC Multimeter to verify power at the cable connections.
3. Power the bus off.
4. Perform a "pull-and-push" test on the red-and-black power cable to verify that the connections between the wires and the PWR terminal are securely fastened:
    - Hold the cables together in one hand, and the 4-pin terminal block in the other.
    - Pull your hands away from each other, then push them together to test the cables.
    - Repeat once or twice. They should remain secure.



Connecting power to the STS unit

The following steps explain how to connect power to the STS units. Please review the following warnings and read the entire section before you begin.

Warning: Do not apply voltage levels that exceed the specified voltage range of 10–30 VDC. Doing so can cause fire and/or an electrical shock.

Warning: Always remove power from the DC circuit before performing any electrical work.

Warning: Always work with a partner who can disconnect the circuit, if necessary, or call emergency services.

Warning: To power the unit on, follow all electrical safety guidelines. Power should be connected only by a licensed electrician.

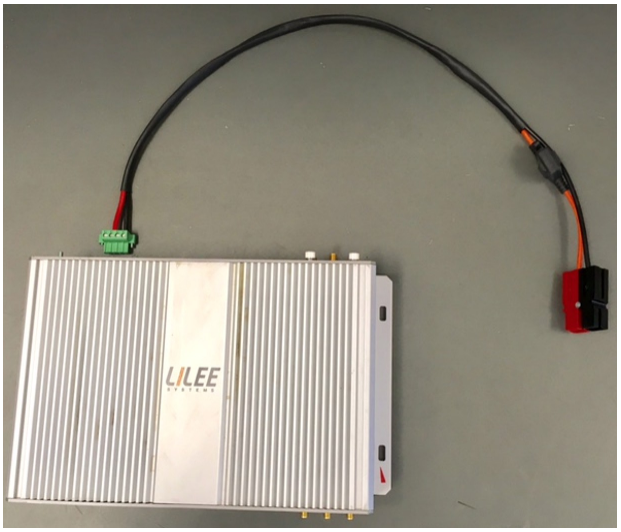
Step 1: STS placement

Place the STS approximately 6 inches from the front side (closest to the front of the bus) of the overhead bin, with the front panel facing you and the bus walkway/aisle.

Step 2: Cable positioning

Place the power cable behind the STS in the overhead bin, to check positioning. **Do not connect yet**.

To ensure proper placement of the STS in relation to the Meraki AP, position the Meraki AP approximately 2 to 3 feet away from the STS (towards the rear of the bus) in the overhead bin, with the front panel facing you and the bus walkway/aisle.

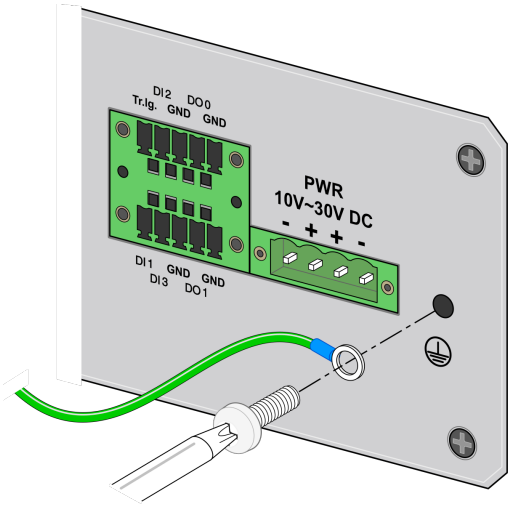


Note: For the power cable shown above, only the green 4-pin terminal block is included with the STS. The installing electrician supplies the remainder of the power cable.

Tip: Do not mount the STS or Meraki AP to the overhead bin until all the LTE and GPS antennas are installed.

Step 3: Grounding

Connect the ground wire to STS unit's grounding screw. At the other end of the power cable, connect the ground wire to a designated ground point in the engine compartment or other suitable ground point designated by the vehicle manufacturer.



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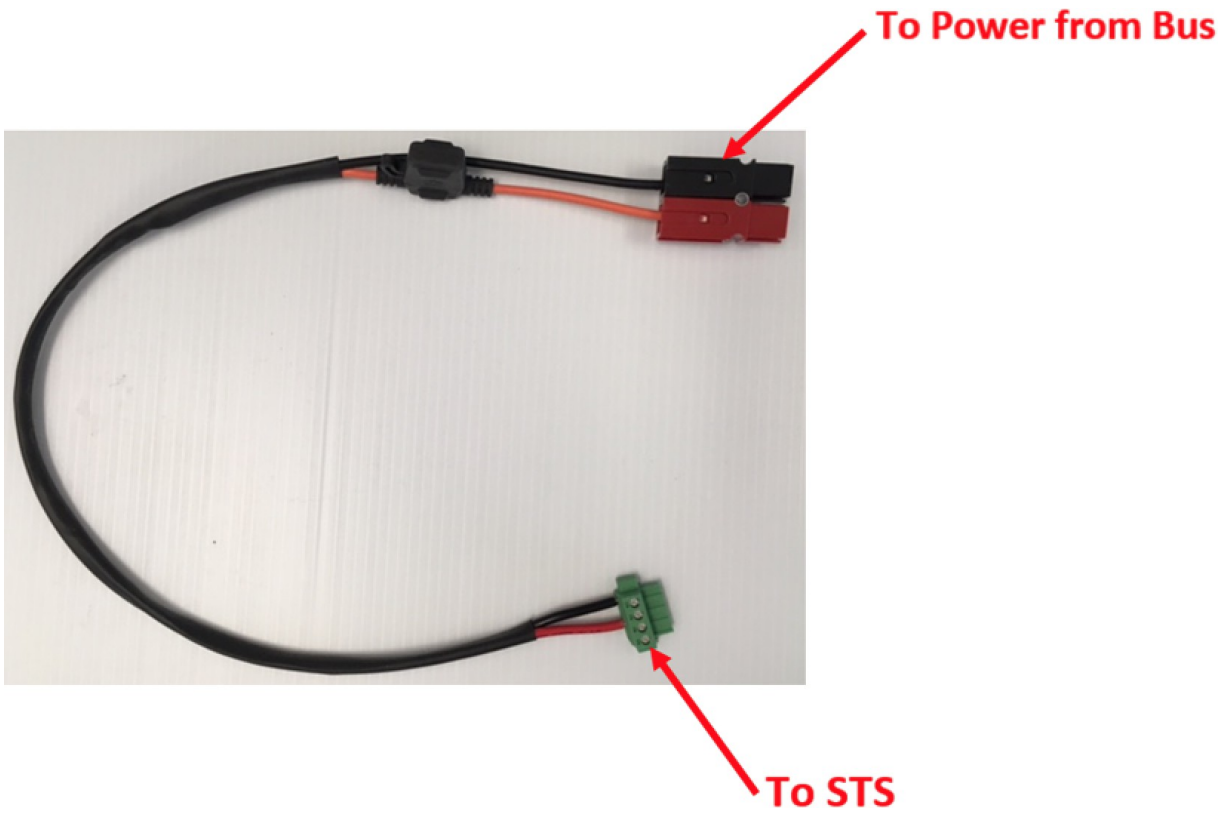
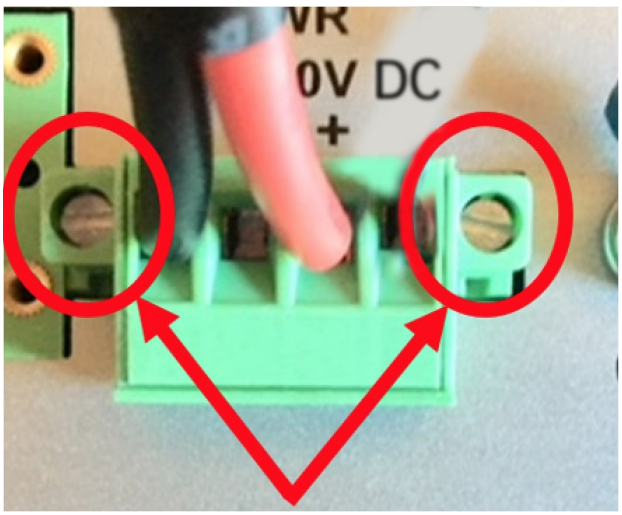
Step 4: Connect power at source end

- Connect the black power wire clamp to the negative (-) terminal of the bus' power.
- Connect the red power wire clamp to the positive (+) terminal of the bus' power.
- Optional, not pictured: Connect your separate true ignition wire to your chosen true ignition circuit.



Step 5: Connect power to STS

- Screw the green block connector on the STS power cable into the DC IN port on the rear panel of the STS.
- Optional true ignition wire, not pictured: In the same manner, connect the 5-pin terminal block to the digital I/O port, immediately to left of the PWR port. The true ignition wire must connect to the pin labeled **Tr.Ig.**. For a photo of this port, please see "Digital I/O connectors" on page 58.



Step 6: Verify power

- Turn the bus power on, then look at the green LED lights on the front panel of the STS. They should be lit.
- If the LEDs do not light, check all your connections (red, black, and white) and verify that they are good. If all connections look good and the LED lights are still not on, contact LILEE Systems.

Step 7: Verify power off

Turn the bus ignition off.

- For hard power on/off installations, the STS unit should shut down immediately.
- For soft power on/off installations, the STS should not shut down immediately, due to the on/off delay feature. It may take up to five minutes for the STS to shut down. "Power on/off delay" on the next page

Power on/off delay

The STS does not start up or shut down immediately. The power on/off delay feature is used for installations in vehicles. The delay in starting up allows time for the engine to start, so the STS is not drawing on the battery when the vehicle is starting. The delay in shutting down accommodates vehicles, such as buses, that turn off their engines at traffic lights and when picking up or dropping off passengers.

The power on/off delay feature requires a true ignition digital hardware input connection (see "Digital I/O connectors" on page 58) and LileeOS software configuration (specifically, the `update boot after-power-cycle on-demand` command). When a vehicle powers on or off, the STS unit detects this via its connection to a true ignition circuit. To learn about true ignition, please see "Choose power connection type" on page 13.

Table: Power on/off delays for the STS

Action	Delay in Seconds	Description
Start up	5	The STS powers on 5 seconds after the vehicle powers on.
Shut down	180	The STS powers off 180 seconds after the vehicle powers off.
Forced shutdown	120	If the STS does not power off 180 seconds after the vehicle powers off, the STS forces an abrupt shutdown after an additional 120 seconds.

3

Antenna Installation

This chapter overs antenna placement and installation.

Antenna position guidelines

Before start the antenna installation process, you should carefully review the antenna placement guidelines and choose where to install the antennas on your vehicle.

- An LTE antenna must be six inches away from metal objects in any direction.
- Fiber material is considered OK
- A GPS antenna only needs to be clear of metal objects above and to its sides.
- LTE antennas must be mounted vertically.
- Antennas going into the same modem/dialer must not be placed side by side, close to each other, or on the same side of the bus.
- Antennas going into two different modems/dialers that are using the same carrier would need to be mounted on the different side of the bus.
- Any deviation from this guideline is **not** allowed without discussion and agreement from the rest of the CIM team.

Warning: If the placement is blocking driver's vision, then we need to find better placement. Safety must be top priority.

Examples of good antenna placement

The following images illustrate antenna placement which complies with guidelines.

Example 1 (two carriers)

- Carrier A: Antennas A0 and A1
- Carrier B: Antennas B0 and B1

GPS: C0

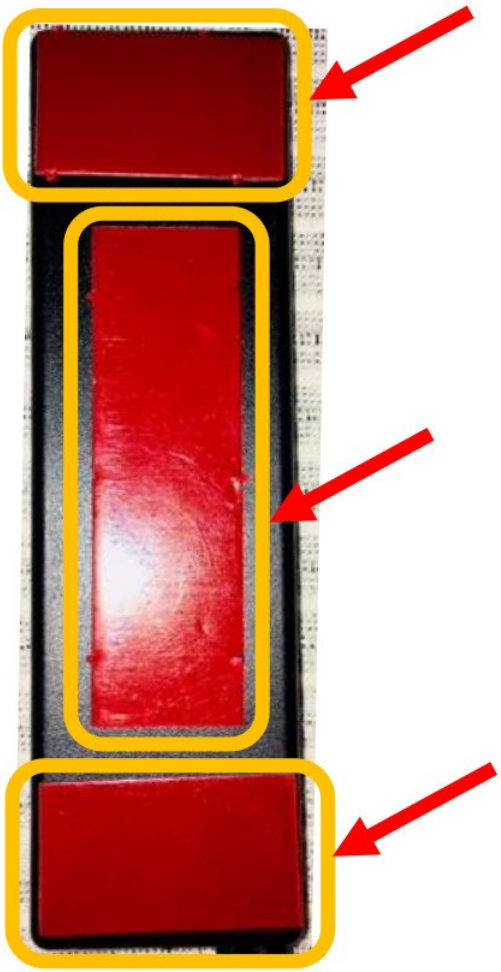
Example 2 (two carriers)

- Carrier A: Antennas A0 and A1
- Carrier B: Antennas B0 and B1
- GPS: C0 (dashboard)

Installing LTE and GPS antennas

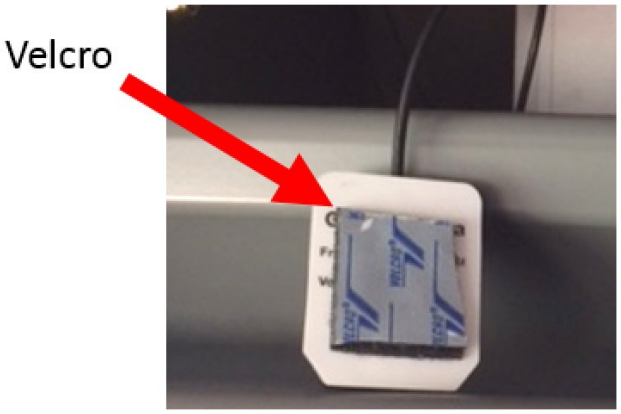
Step 1: Tape LTE antennas

Apply three strips of double-sided adhesive tape to the back of each LTE antenna. You must apply the tape in an "I" formation, as shown here:



Step 2: Tape GPS antenna

For the GPS antenna, apply a square of Velcro tape to the backside of the antenna, like this:



Step 3: Labeling

Use sharpie pens and electrical tape to number each antenna **and** its plug end.

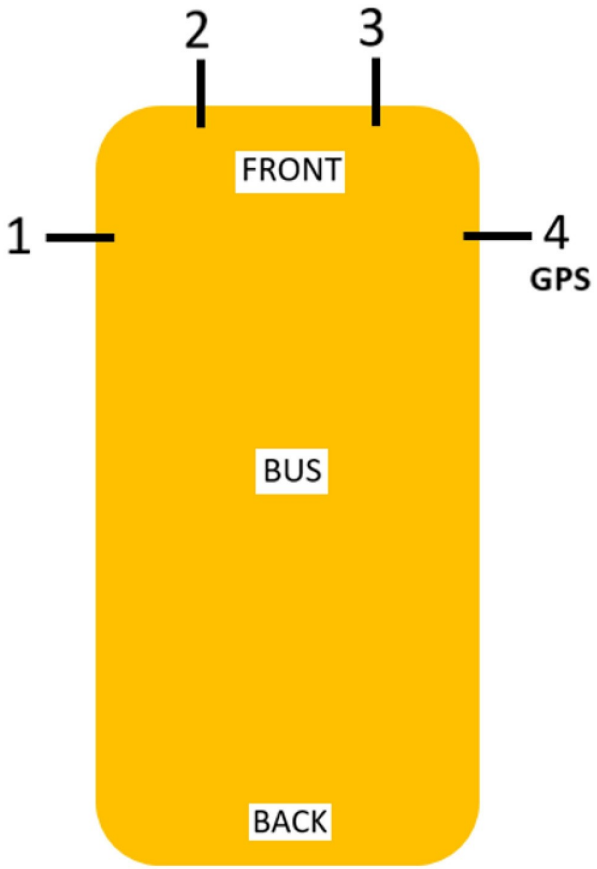
> **Tip:** Label the *fronts* of the antennas with electrical tape so that your numbers are still visible during and after final attachment--in other words, don't label just the adhesive backing which you will be peeling off.

Step 4: Cable routing

Before attaching anything to the bus, route the antenna cables from the STS unit to the antenna locations to ensure proper placement. Once you have verified the route, secure the cables such that they will not be disturbed or moved in transit. **Do not attach the anntennas yet.**

Tip: For cut-away buses, GPS antenna location should be the top of the dashboard. For larger buses, it will go on the lip of a window seal pointing upwards.

When routing, use the following diagram as a guide for placement:

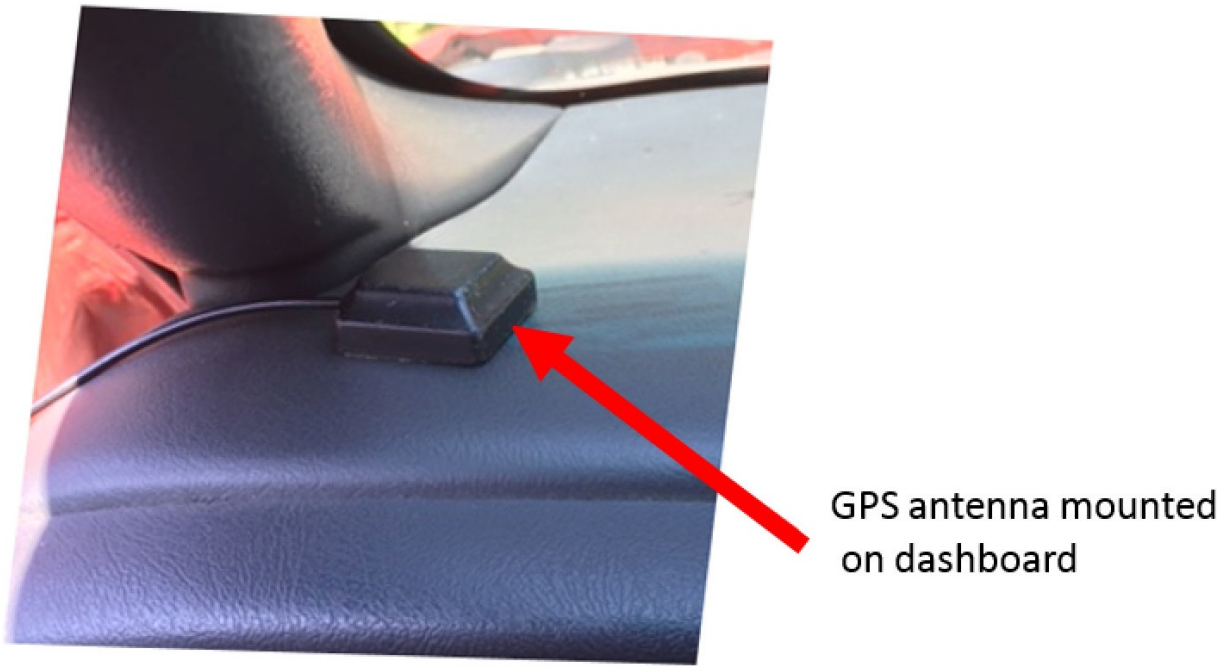


Note: The number of window-mounted LTE antennas required depends on the number of SIM cards installed in the STS, and exact placement locations will depend on the type of bus.

Step 5: Verify and attach LTE and GPS antennas

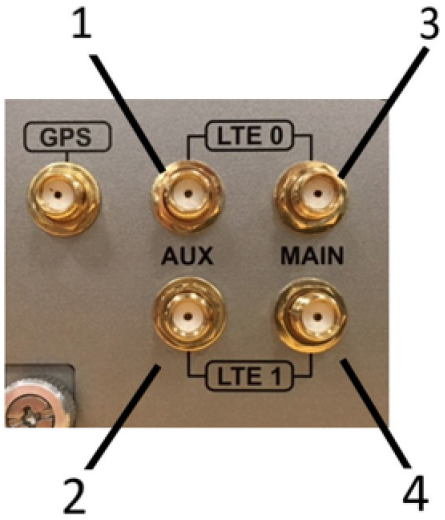
Using the numerical labels that you added to each antenna/plug, do a final placement check prior to attachment.

Once you're sure each antenna is in the correct place, remove the adhesive backing from the double-backed tape and attach to the pre-selected locations.



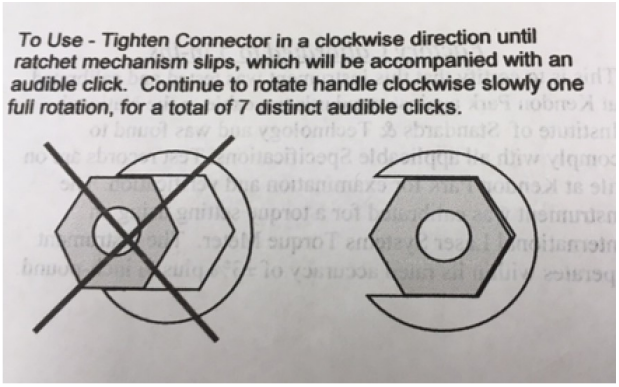
Step 6: Attach antennas to posts

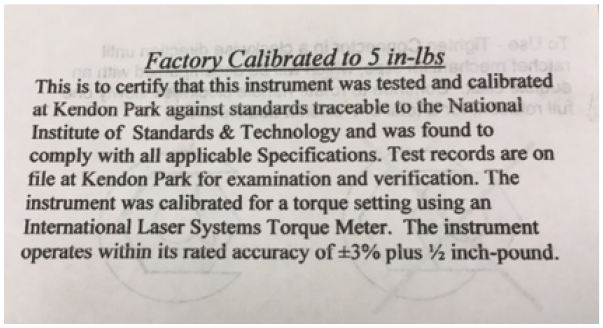
By hand, fasten the LTE 0, LTE 1, and GPS antennas securely onto the front of the STS, connecting each numbered antenna to its corresponding post as shown. (use diagram on step 2 and step 4).



Set torque of connectors

After connecting all antennas (LTE, GPS, and Wi-Fi) to the STS, use an SMA 5/16 (3.5 mm) torque wrench. Tighten all connectors until torque wrench clicks, and repeat click 5 to 7 times for full antenna connection.





4

Mounting the STS and Meraki Units

This chapter describes how to mount the STS and Meraki units. Please review the following warnings and read the entire chapter before you begin.

Note: Do not install the STS in a site where the ambient temperature exceeds the STS rated temperature of -40 to 158 °F (-40 to 70 °C).

Warning: The STS is intended to be mounted on a wall or in an overhead bin. Read the mounting instructions carefully before installing. Follow the instructions closely and use the correct hardware to avoid damaging the equipment or creating a hazard for people due to uneven mechanical loading.

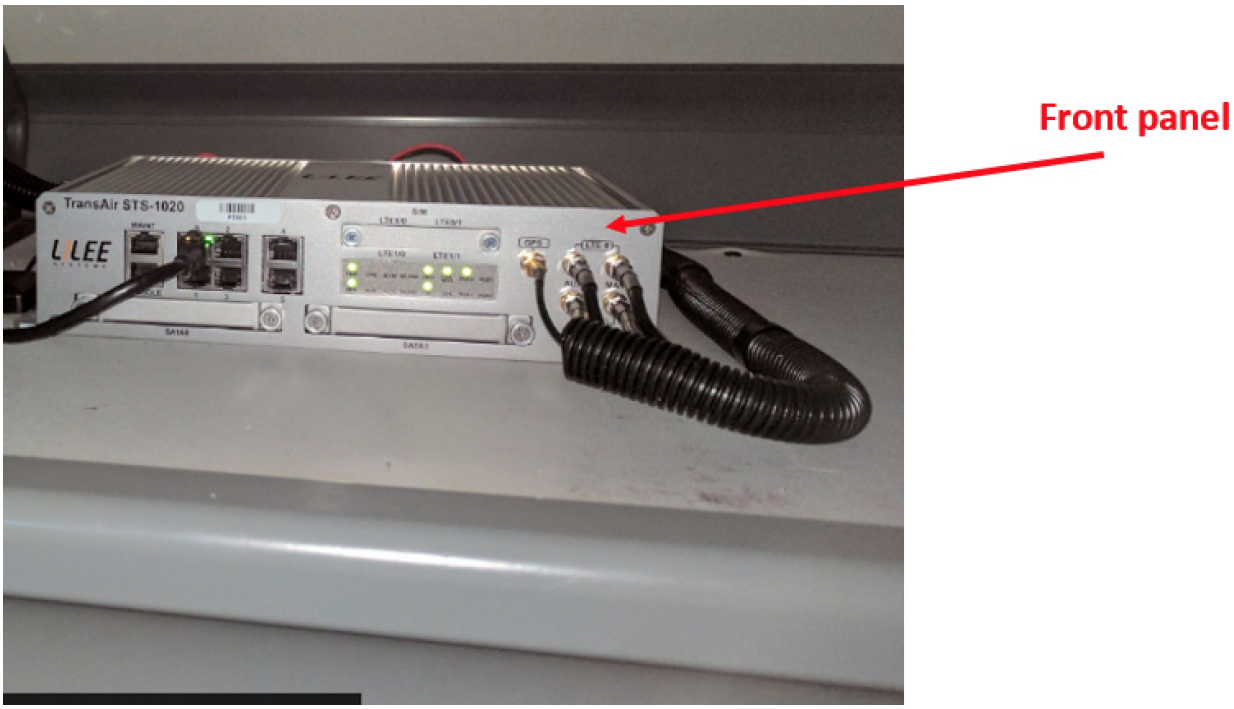
Caution: Follow electrostatic precautions whenever installing the STS. To prevent malfunction or damage from electrostatic discharge, ground the STS. Before touching components, or connecting or disconnecting cables, touch a metal object to dissipate your body charge.

Caution: Ensure that the power cord is disconnected whenever you service, install, or move the STS.

Mounting the STS unit

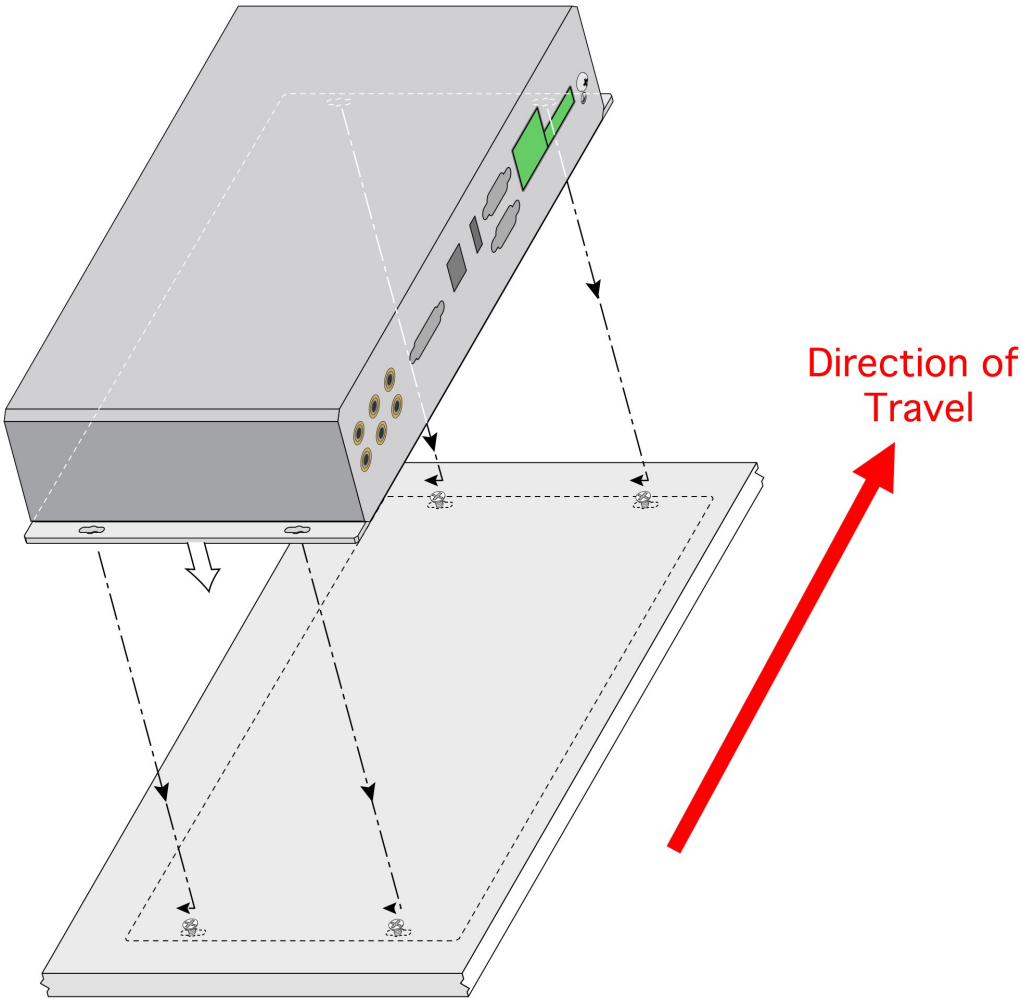
Step 1

Verify that the front panel of the STS is facing you and the bus walkway/aisle.



Step 2

Mount the base of the STS in the overhead bin using four of the #8-32 x ¾ in. long self-piercing screws and the Phillips screwdriver. Mount only the STS in place; do not use these screws to mount cable ties or anything else.

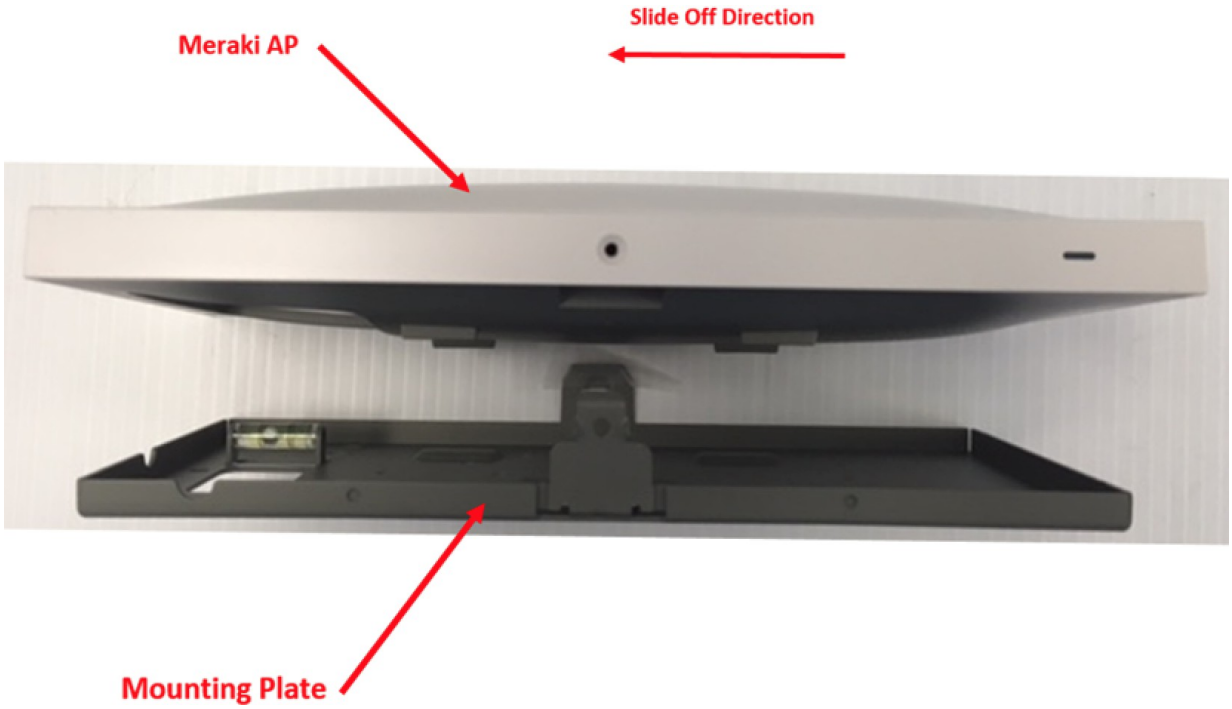


LIL_097

Connecting and mounting the Meraki access point

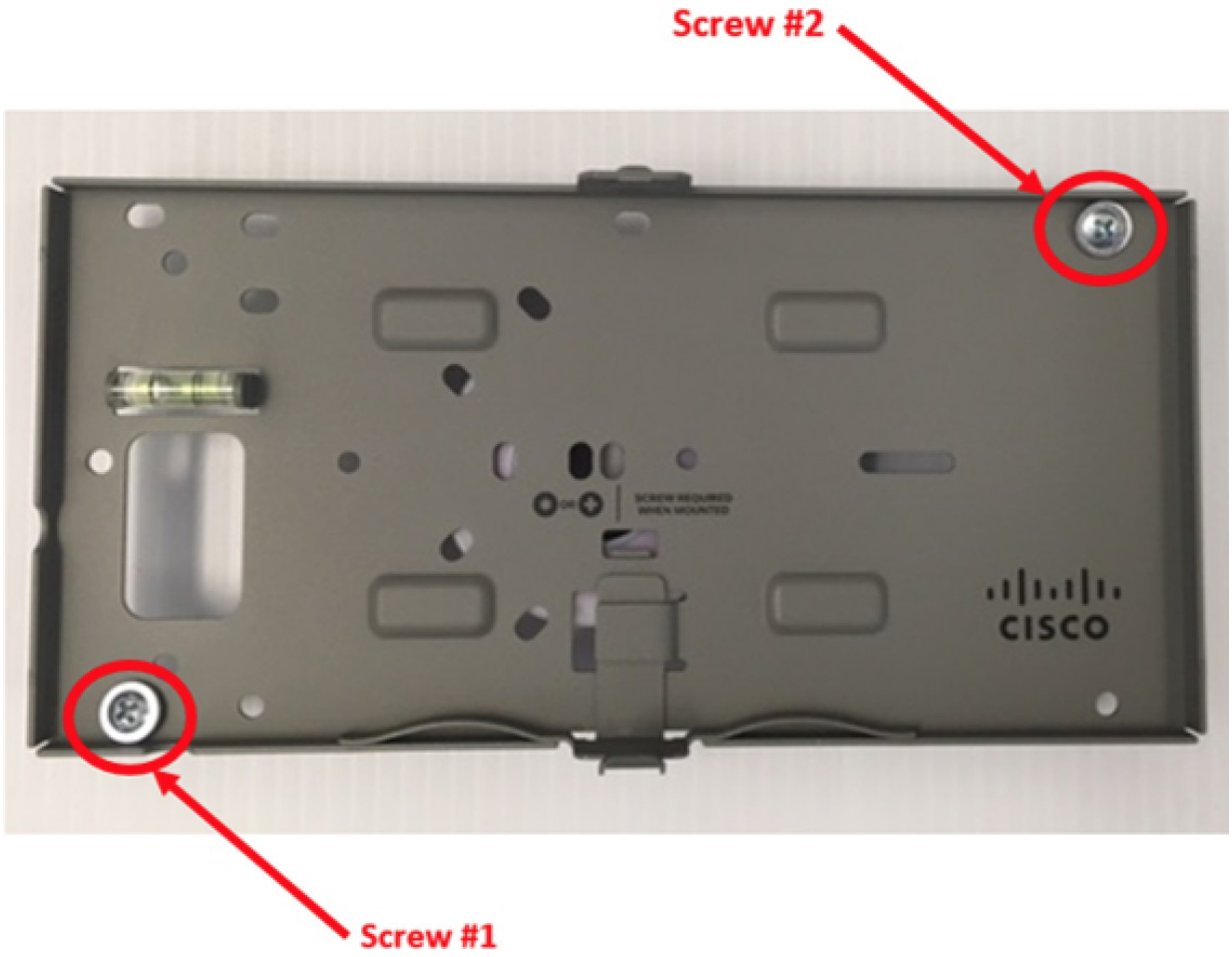
Step 1

Slide the Meraki AP off the mounting plate before attaching the plate to the overhead bin.



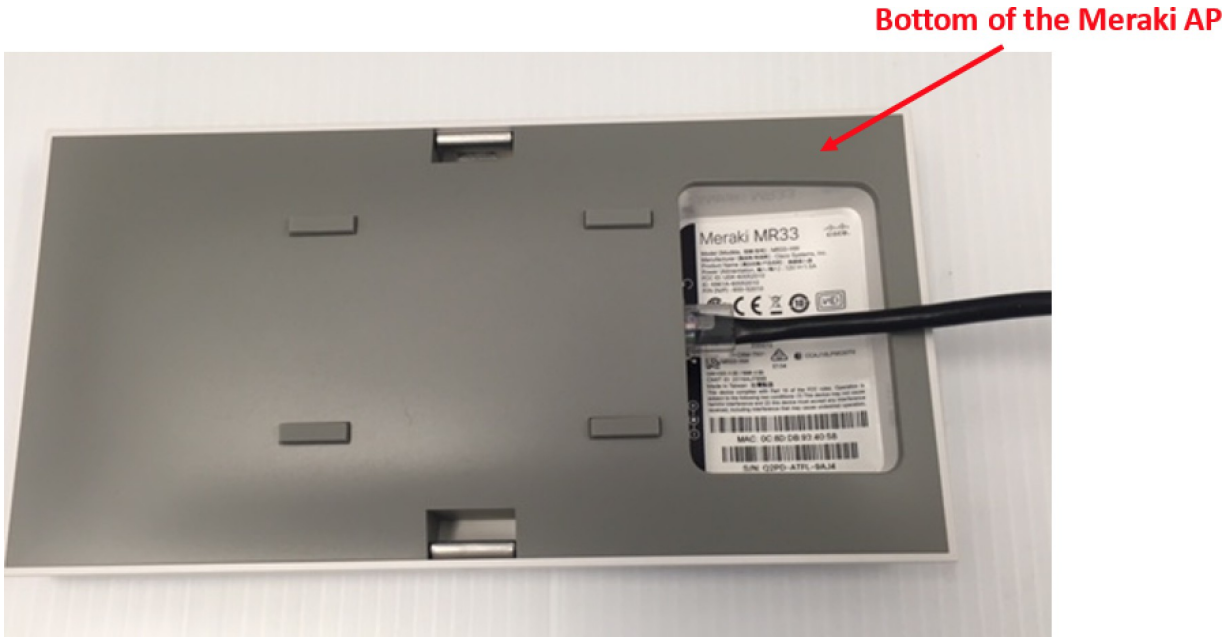
Step 2

Mount the Meraki AP installation plate using two of the #8-32 x ¾ in. long self-piercing screws and the Phillips screwdriver.



Step 3

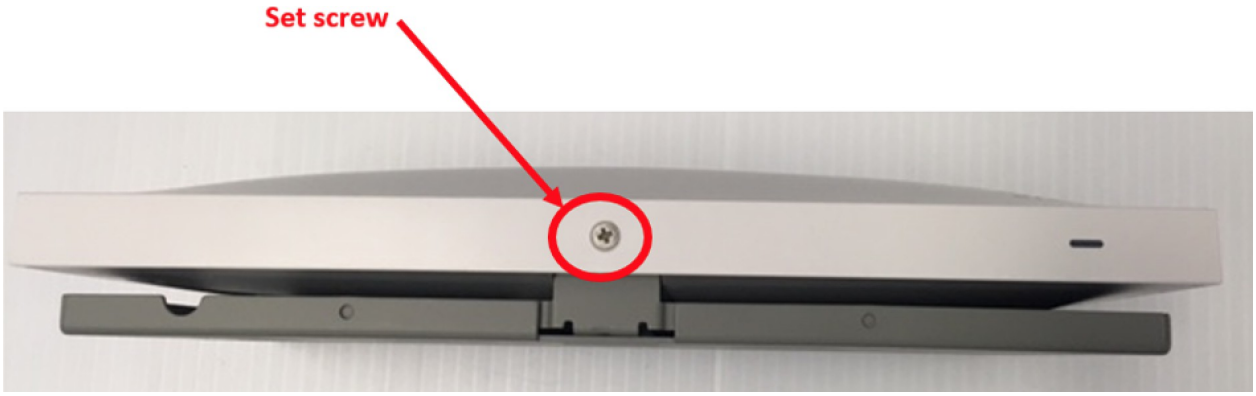
Connect one end of the RJ45 Cat-6 Ethernet cable (3 ft.) to the bottom side of the Meraki AP, and the other end to the PoE Port 0 on the front panel of the STS.



Step 4

Slide the Meraki AP onto the mounting plate.

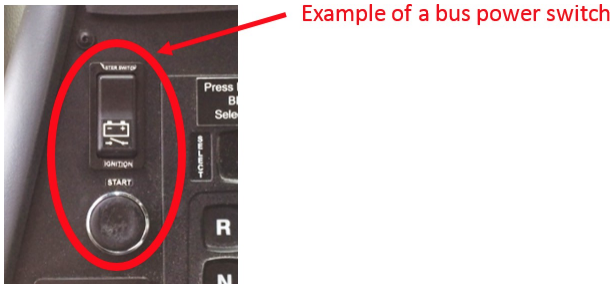
Use the set screw provided with the Meraki AP to fasten the unit in place.



Completing the installation

Step 1

Turn on the bus.



Step 2

Complete the post-Installation Checklist to verify that the system is working properly.

5

Configuration

This chapter describes software settings which may require attention immediately after the physical installation is complete. In some scenarios these items may preset by an administrator or configured via LILEE Systems T-Cloud.

Set cloud or local management

Starting with LileeOS 4, STS hardware will default to using the LILEE Systems T-Cloud platform for management. If you plan to manage a unit locally instead of via T-Cloud, you must disable centralized management during hardware onboarding to achieve local mangement of the a unit.

The update centralized-mode command would disable T-Cloud control of the unit, like this:

```
DTS-2000 > update centralized-mode disable
```

Setting STS position

To learn your STS position, please see "Determining STS position" on page 9.

Once you know the reference number of the position in which you have installed the STS, you must update the value for the parameter sts_position in the file /etc/adas/config.yml for any position other than 19 (which is the default).

Follow these steps at the command line on the STS unit:

```
$ sudo overlayroot-chroot
# vim /etc/adas/config.yml
```

Change the value of sts_position from 19 to the position you are using.

```
# exit
$ reboot
```

Cellular firmware

Under some circumstances, you may need to update carrier firmware of the LTE module prior to use. This chapter explains how to check the firmware version and, if necessary, update it via the command line on a locally-managed STS unit.

Warning: Firmware updates for cellular carriers and cellular hardware are provided by third parties and pass through LILEE Systems as a convenience. A compatibility issue with a firmware release could render a unit inoperative, so you should research the compatibility of a given firmware update with your specific hardware configuration prior to application. LILEE Systems does not guarantee the functionality of third-party updates which pass through the T-Cloud system.

Tip: Users managing their STS units via LILEE Systems T-Cloud may perform checks and updates in the portal and thus don't need this section.

Checking firmware version

Step 1: Be sure the unit is connected to power, then ensure that the SIM card is correctly installed with the following command:

```
debug interface cellular <interface-number_0_or_1> atcmd “at+cpin?”
```

For example:

```
STS-1020 > debug interface cellular 0 atcmd "at+cpin?"
timeout set to 5 seconds
send (at+cpin?^M)
expect (OK)
at+cpin?
+CPIN: READY

OK
-- got it

STS-1020 >
```

The READY result indicates that the SIM is correctly installed.

Step 2: Download the latest carrier firmware from the Lilee Systems FTP site. Put it in a location accessible from the STS via FTP, TFTP, or HTTP. (HTTP is recommended.)

Warning: Warning: Do not upgrade directly from the LILEE Systems FTP site, as a communication interruption can disable your card.

Step 3: Log in to the LileeOS command line on the STS.

Step 4: Check the firmware version with the following command:

```
show interface cellular <interface-number_0_or_1> device
```

For example:

```
STS-1020 > show interface cellular 0 device
MODULE : MC7430                                IMEI : 359074060097096
SN : LU62640515021012                          ESN : 0
MEID : 35907406009709                          FW VERSION : 02.24.05.06
PRI VERSION : 002.026.000                      PRI CARRIER : GENERIC
FW MODE : Online
localhost.localdomain >
```

Compare the Revision with what you downloaded in step 2.

If you have determined that you need to update the carrier firmware at this point, follow the steps in the next section.

Upgrading cellular firmware

Each LTE module in the STS can store up to four firmware images, of which one is active. Upgrading the firmware thus consists of two procedures:

- Installation of new firmware
- Switching the active image to the one you updated

To perform both of these procedures, follow these steps:

Step 1: Log in to the LileeOS command line on the STS.

Step 2: Enter the following command:

```
update interface cellular <interface-number_0_or_1> image <path_to_firmware>
```

For example:

```
STS-1020 > update interface cellular 0 image http://10.2.10.21/SWI9X30C_02.30.03.00_
Generic_002.046_001.zip
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 60.8M  100 60.8M    0     0  11.1M       0  0:00:05  0:00:05 --:--:-- 11.2M
Extract zip file
Updating firmware
--------------------------------------------------
Apply settings
------------------
Please wait 2 mins for the module to switch the active firmware image.
During this time, the module will disconnect and reconnect a few times.
localhost.localdomain >
```

Caution: After the new command prompt appears as shown in the example immediately above, you must wait an **additional two minutes** before continuing to the next step. During this time, the module will disconnect and reconnect a few times in the background.

Step 3: Verify that the image is installed with the following command:

show **interface cellular** <**interface-number_0_or_1**> **firmware-list**

For example:

STS-1020 > show **interface cellular** 0 **firmware-list**

```
Index | Carrier ID | Folder ID | Storage Type | Pri Image ID | Pri Image Build ID  | FW Image Build ID | Active
-------------------------------------------------------------------------------------------------------------
1       4            2           0              002.027_000    02.24.05.06_ATT       02.24.05.06_?       V
2       1            6           0              002.026_000    02.24.05.06_GENERIC   02.24.05.06_?
3       5            1           0              002.034_000    02.24.05.06_VERIZON   02.24.05.06_?
4       11           3           0              002.022_000    02.24.03.00_SPRINT    02.24.03.00_?
localhost.localdomain >
```

Tip: From the output, note the index number of the firmware that you wish to activate. You will need that in a moment.

Step 4: Reboot the STS-1020.

STS-1020 > **reboot**

Step 5: Enter the following command to switch the active firmware image to a new image, using the firmware index number you noted above.

update **interface cellular** <**interface-number_0_or_1**> **firmware-switch** <**firmware_index_number**>

For example:

```
localhost.localdomain > update interface cellular 0 firmware-switch 2
Updating firmware
----------------Apply settings
localhost.localdomain >
```

Caution: After the new command prompt appears as shown in the example immediately above, you must wait an **additional two minutes** before continuing to the next step. During this time, the module will disconnect and reconnect a few times in the background.

Step 6: Verify that the active image is now the new firmware image by repeating step 3 above.

Tip: When you look at the command output, the active image is marked with a **V** in the Active column.

Step 7: Reboot the STS-1020.

STS-1020 > **reboot**

The SIM cards are updated and ready to use.

Update the preferred roaming list (Sprint, Verizon)

The STS unit will automatically update the preferred roaming list (PRL) for Sprint and Verizon at the beginning of every month. At time of installation, you should manually trigger the update as a one-time procedure. This does not apply when using other carriers.

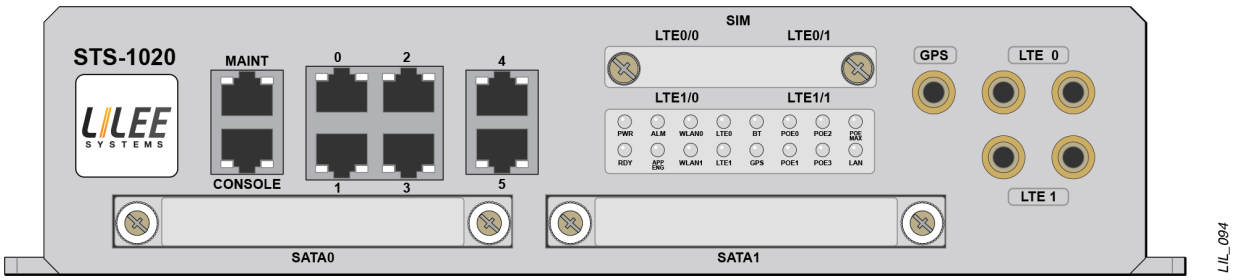
To update the PRL, execute this command as root:

```
STS-1020 > update interface cellular<index> preferred-roaming-list
```

6

Front Panel Ports and Indicators

This chapter describes the ports, indicators, and connectors located on the front of the STS hardware. The following figure illustrates their names and locations:



Maintenance port

The STS has one RJ45 Ethernet port for secure local maintenance. The port has two indicator LEDs, a link light (green) and an activity light (amber).

LED	Behavior	Description
Green	On	Link
Green	Off	No link
Amber	Off	No traffic
Amber	Flashing	Data traffic

Console port

The STS has an RS-232 serial console port with an RJ45 connector for direct local management. When you connect, you may need to adjust the defaults in your console program to make a connection. The following table lists the proper settings for connecting to the STS console port.

Setting	Value
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

Gigabit Ethernet ports

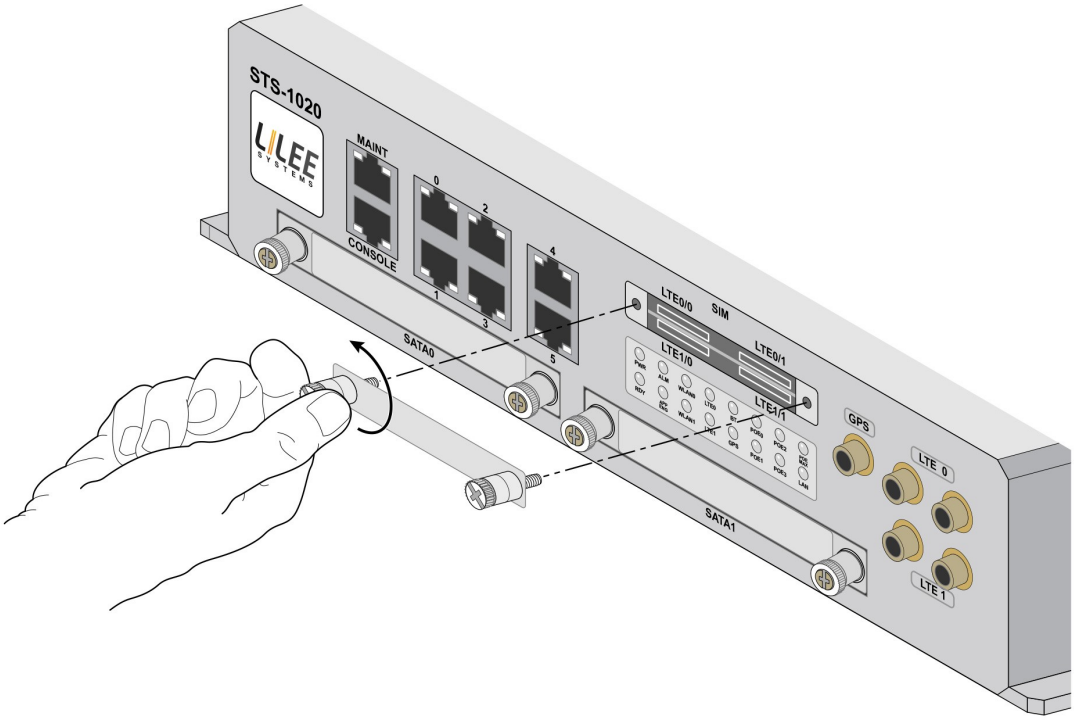
The STS has six RJ45 10/100/1000Base-T Gigabit Ethernet ports for connecting to a local network, numbered 0 throught 5. Ports 0 to 3 provide power over Ethernet (PoE) to connected devices. Each port has a set of LED indicator lights, which behave identically to those of the Maintenance port (see "Maintenance port" on the previous page).

SIM card bay

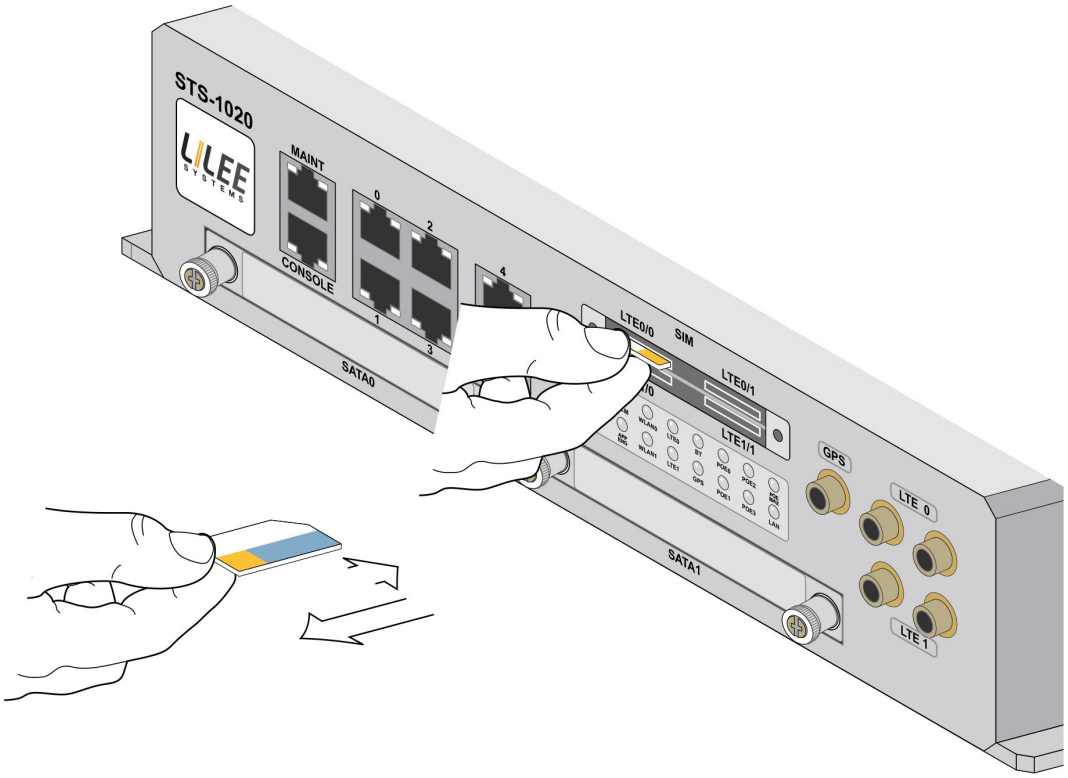
The STS-1020 has a bay for four 2FF standard-sized (15 x 25 mm) SIM cards. The STS-1010 has a bay for two 2FF standard-sized (15 x 25 mm) SIM cards. The thickness tolerance for each SIM card is 0.71 to 0.81 mm. If you use a 3- in-1 SIM card with 0.67 mm thickness, proper functionality is not guaranteed.

To install or replace a SIM card:

1. Remove power from the STS.
2. Remove the dust control door using a Phillips-head screwdriver or your fingers, as shown here.

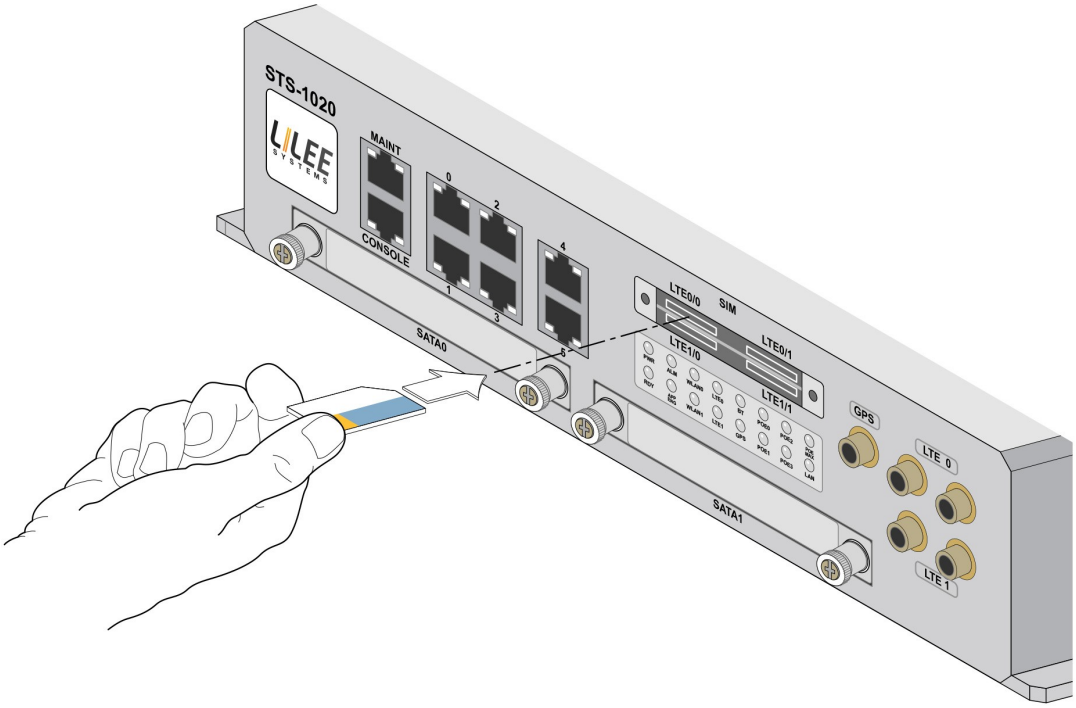


3. If a SIM card is present, press gently to release it from the spring-loaded mechanism, then remove it.



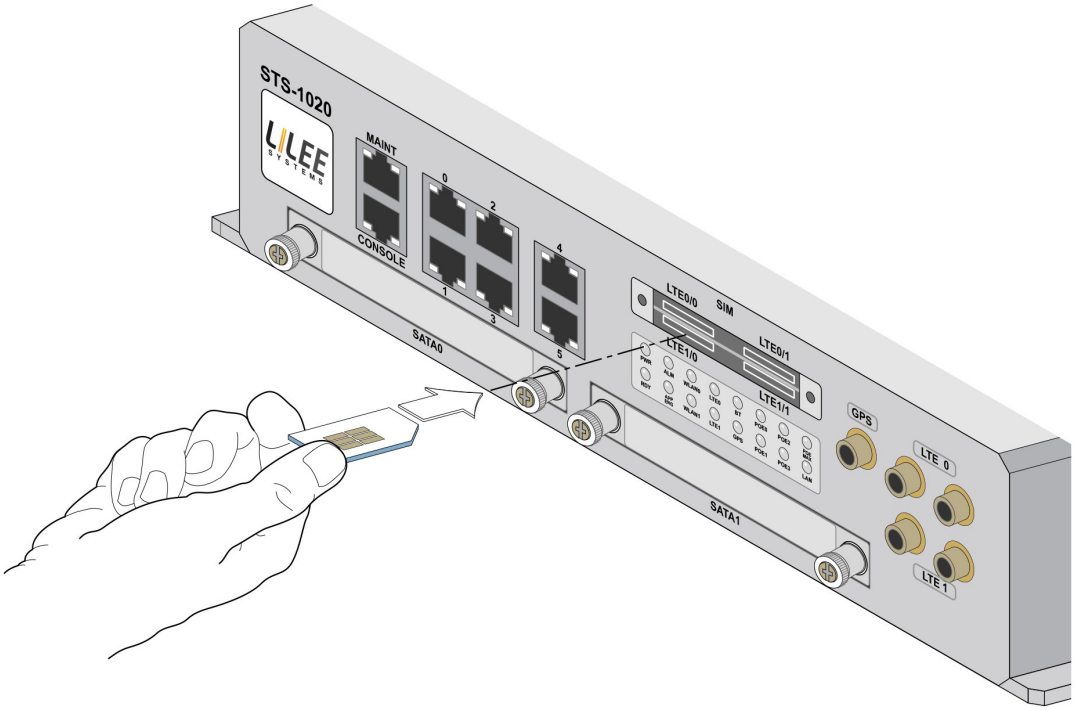
LIL_103

4. Insert the new SIM card in slot LTE0/0, as shown below, with the notch facing the front of the card and the metallic contacts facing down (do not touch the metallic contacts). You will feel resistance as the card pushes against a spring. When you hear a click, the card is installed.



LIL_104

5. Optional: When using two SIM cards with an STS-1020, insert the second new SIM card in slot LTE1/0, as shown below.



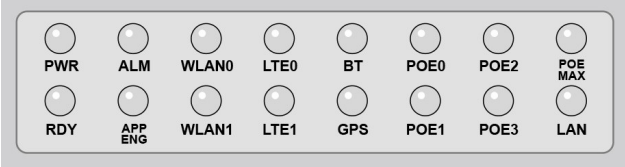
LIL_105

6. Replace the dust control door and tighten its screws.

The SIM installation procedure is complete.

LED indicators

The following table describes behaviors for the front-panel LED indicator lights.



LED	Behavior	Description
PWR	Off	No power
	Green	Power on
	Amber	Standby power
RDY	Green	LileeOS ready
	Amber	LileeOS in sleep mode
CPU	Off	Application Engine off, or system asleep
	Green	Application Engine enabled
	Green flashing	Contact Support.
	Amber	Disk access
ALM	Off	Normal
	Green	Temperature above 77 °C (this LED might flash during a factory reset).
	Amber	Voltage above 31.5 V or below 9.5 V (this LED might flash during a factory reset).
AUX0-1	Off	User defined
	Green	User defined
	Amber	User defined
WLAN0-1	Green	2.4 GHz connection
	Amber	5 GHz connection
LTE0-1	Green	4G connection
	Amber	3G connection
POE MAX	Off	PoE controller is not initialized.
	Green	PoE controller is initialized and can support at least one more high power PoE device.
	Amber	PoE controller is initialized but cannot support more high power PoE devices; a low power device might be supported.
GPS	Green	Reserved
	Amber	3D location acquired

LED	Behavior	Description
POE0-3	Off	No power supplied, because either the device does not support PoE or not enough power is available.
	Green	Power is supplied to the connected device.
	Amber	Power is not supplied to the connected device due to an error on the module or the device.

GPS antenna connector

The STS has a female SMA connector for connecting a GPS antenna.

Cellular antenna connectors

The STS-1020 has four female SMA connectors for connecting cellular antennas—two for LTE 0 and two for LTE 1. The STS-1010 has only two female SMA connectors (LTE 0 only). Use the connectors on the right (labeled MAIN) for the main antennas. Always connect both the antennas (MAIN and AUX); we do not recommend using a single antenna.

Use the following guidelines when mounting the cellular antennas:

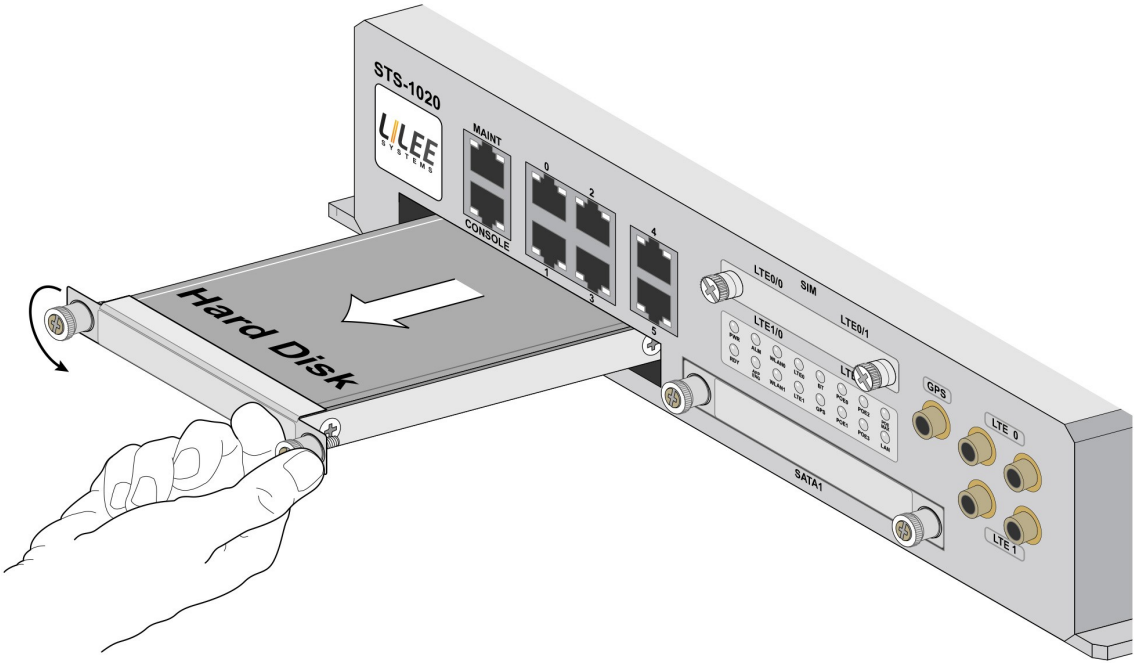
- Place the two antennas (MAIN and AUX) a distance apart from each other that is greater than one radio wavelength to maximize MIMO gain. If space is limited, try placing the antennas at least a quarter of a wavelength apart. A radio wavelength of eighteen inches corresponds to a frequency of 656 MHz (approximately the lowest LTE band frequency).
- Orient the antennas in a vertical position to ensure that the antenna gain is omnidirectional (meaning the antenna can receive signals from all directions).

SATA SSD bays

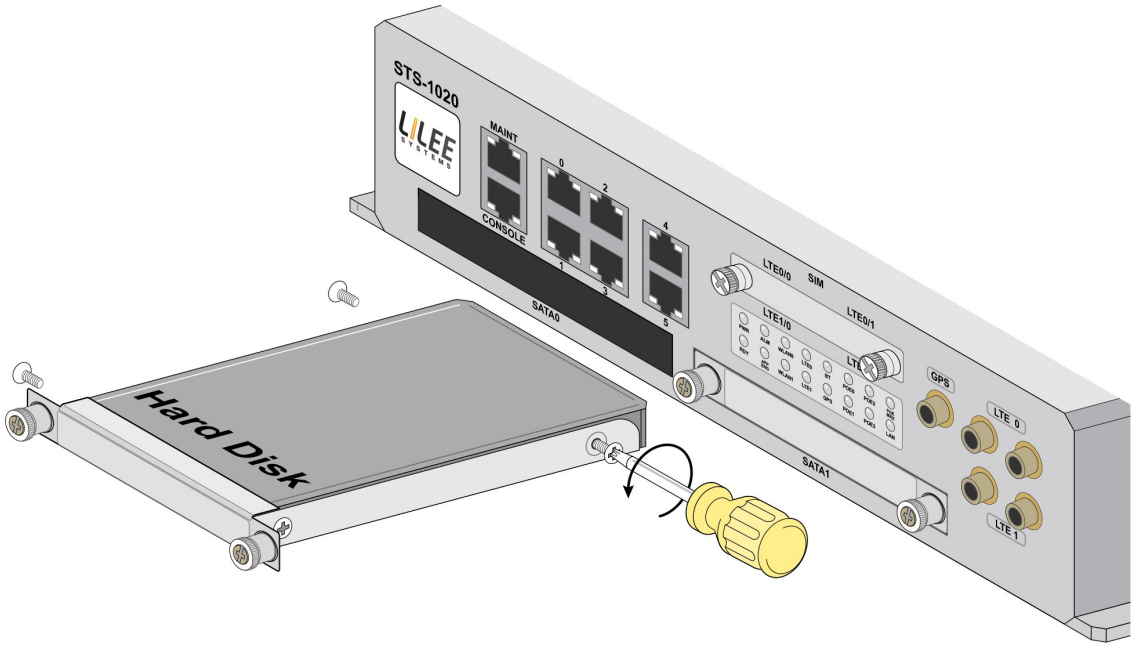
The STS-1020 has two bays for 2.5" SATA SSDs (SATA0 and SATA1). The STS-1010 has only SATA0. The included 32 GB drive (SATA0) ships in the accessory box. SATA1 ships empty, and you may contact LILEE support for information on optional SATA1 drives. Upon unpacking, insert the included drive at SATA0 as shown in Figure 15, below, and tighten the thumbscrews by hand (maximum 2 inch-pounds if using a screwdriver).

To replace an existing SSD or to install a new SSD in the SATA1 bay:

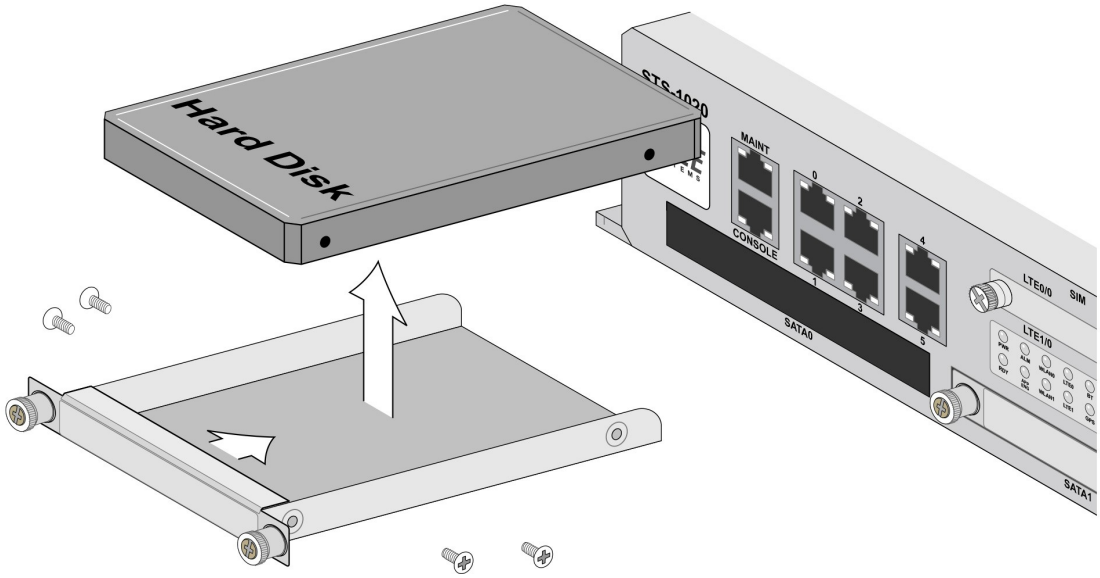
1. Remove power from the STS.
2. Remove the SSD tray from the front of the STS by unscrewing the two socket-cap Phillips-head screws at the SATA bay. Slide the tray out, as shown below. To replace an SSD, continue to step 3. To install an SSD in bay SATA1, proceed to step 5.



3. Unscrew the four Phillips-head screws from the sides of the SSD tray with a small Phillips-head screwdriver.

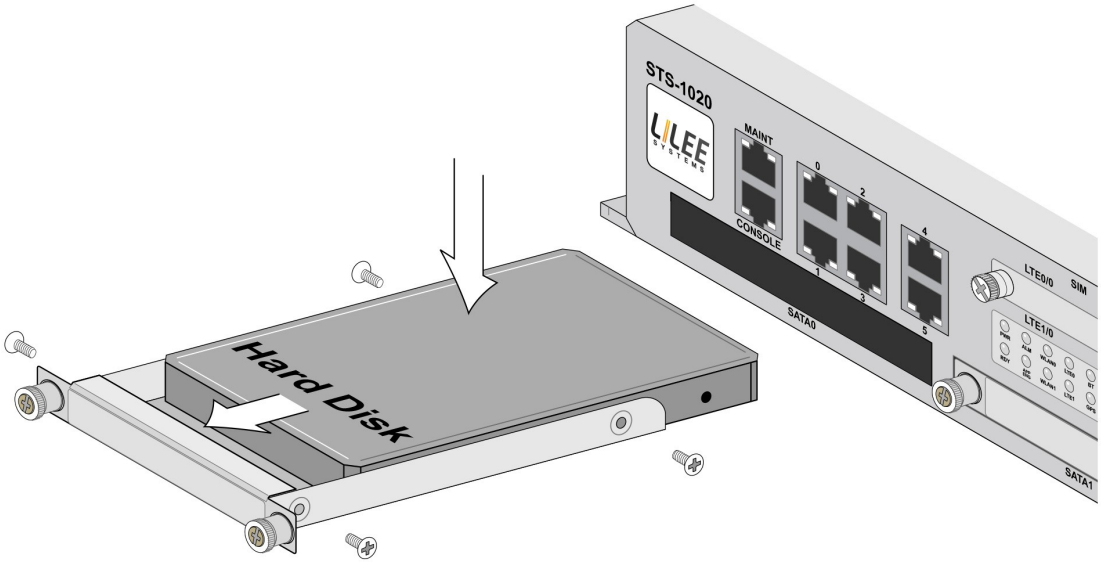


4. Slide the SSD toward the rear of the SSD tray, and lift it out.



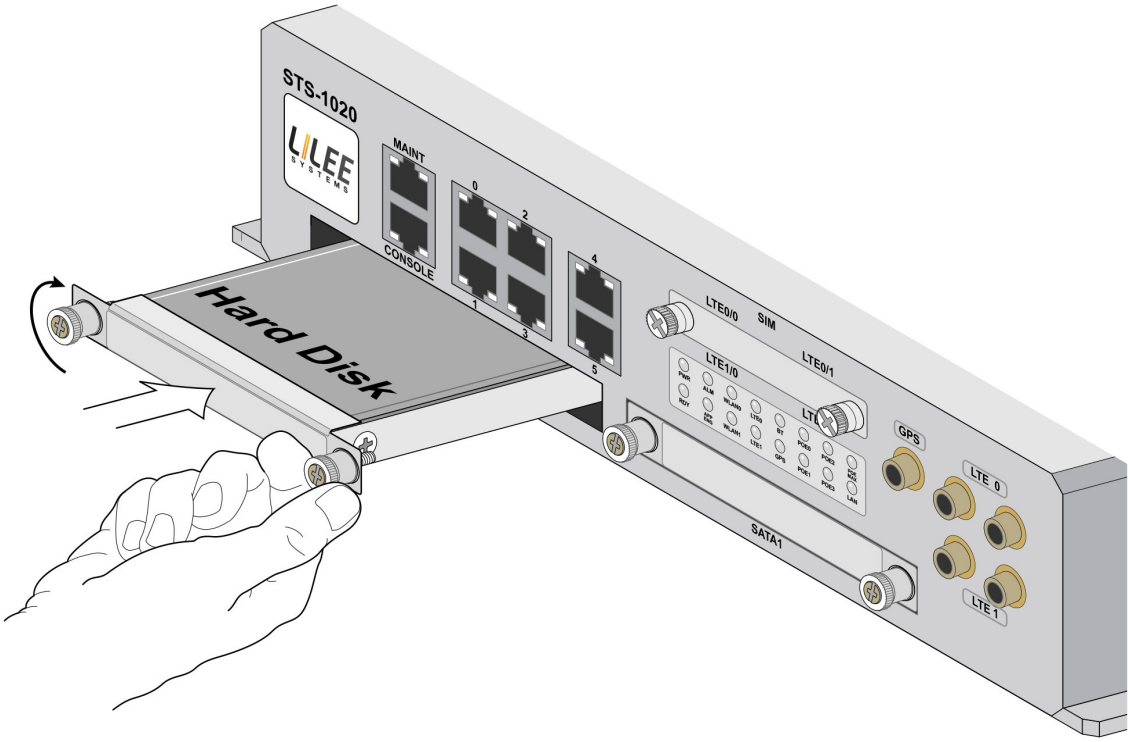
LIL_112

5. Place the new SSD into the tray and slide it forward to fit under the lip in front. Ensure it has the correct orientation, and secure in place with the four Phillips-head screws provided.
   Note: Be sure to properly orient the signal ports on the back of the HDD/SSD. These must rest at the rear of the HDD tray to ensure proper connection to signal interfaces.



LIL_113

6. Slide the SSD tray back into the SATA bay and secure it to the STS by replacing the two socket-cap Phillips-head screws previously removed.

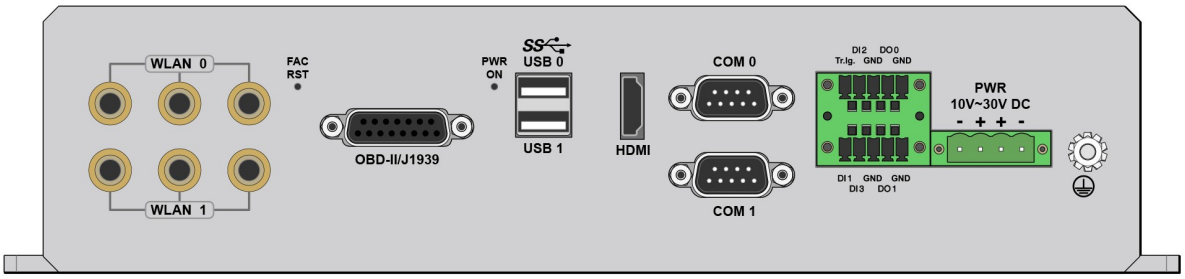


The SSD installation procedure is now complete.

7

Rear Panel Connectors and Indicators

This chapter describes the ports, indicators, and connectors located on the rear of the STS hardware. The following figure illustrates their names and locations:



WLAN connectors

The STS has six female RP-SMA connectors for connecting Wi-Fi antennas. Each Wi-Fi interface has connectors for three antennas, enabling 3 x 3 MIMO.

Reset button

If the STS console becomes unresponsive, press and hold the reset (FAC RST) button. The button can perform three different functions; which is determined by how long you hold button down, as described in the table below.

Hold Duration	Function	PWR LED behavior
1 to 3 seconds	Reboot	Solid green
3 to 10 seconds	Reset to factory defaults and reboot.	Blinking green
Greater than 10 seconds	Reset to factory defaults and reboot with the minimum configuration.	Solid green

OBD-II/J1939 connector

The STS has a female DB15 serial port for an OBD-II/J1939 connector. Contact support@lileesystems.com to obtain information on how to purchase an OBD-II or J1939 cable that is appropriate for your vehicle.

This table lists the pins and their descriptions:

Pin	Description
1	N/A
2	N/A
3	N/A
4	N/A
5	CAN1 High(+) — Reserved
6	GND
7	CAN Shield
8	Battery voltage input (for reference only)
9	N/A
10	CAN1 Low(-) — Reserved
11	N/A
12	CAN0 Low(-) — OBDII/J1939
13	CAN0 High(+) — OBDII/J1939
14	Reserved
15	Reserved

Power button

The power button is accessed through the pinhole labeled PWR ON and provides the following functionality:

- Power on the device—If the device is powered off, press the power button once to power the device on.
- Enable sleep mode—Power on the device first, then press the power button once to enter sleep mode. Press the power button again to exit sleep mode.
- Force a system shutdown—If the device is unresponsive, press and hold down the power button for 4 seconds to force the system to shut down.

USB flash drive ports

The STS has two USB flash drive ports. The top port, USB 0, is 3.0. The bottom port, USB 1, is 2.0.

HDMI port

The STS has an HDMI connector for attaching a monitor. The HDMI connector supports brand name HDMI cables. The Philips SWV5401H version 1.4 cable was used during testing.

COM ports

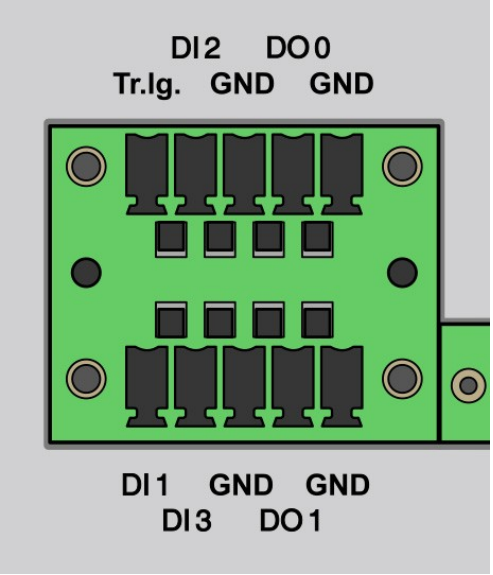
The STS has two COM ports, COM 0 and COM 1, with male DB-9 connectors for direct local management. To facilitate the COM port mode switching, the termination resistor used for accurate RS-422/RS-485 communication is integrated into the STS system. No termination resistor is required when the COM port is configured to RS-422/RS- 485 full-duplex or RS-485 half-duplex mode.

This table lists the pins and their descriptions for the DB-9 connectors:

Pin	RS-232	RS-422/RS-485 Full Duplex	RS-485 Half Duplex
1	DCD	TX-	Data-
2	RXD	TX+	Data+
3	TXD	RX+	-
4	DTR	RX-	-
5	GND	GND	GND
6	DSR	-	-
7	RTS	-	-
8	CTS	-	-
9	RI	-	-

Digital I/O connectors

The STS has two 5-pin terminal block connectors for four digital input and two digital output signals. All signals are isolated from the STS internal electronic system.



Digital I/O pin definitions

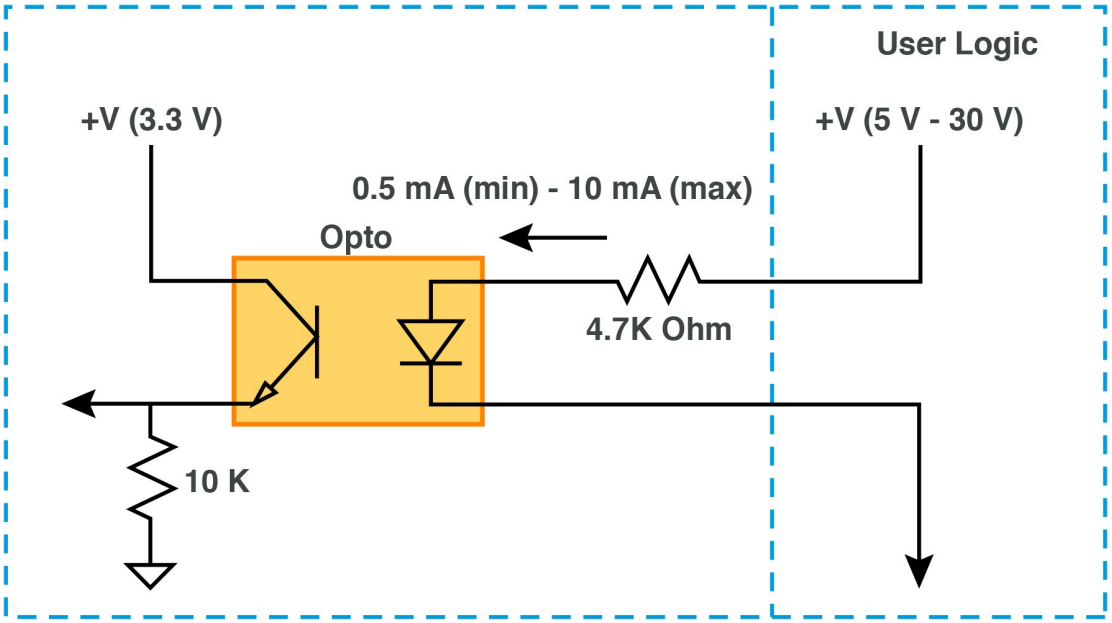
Pin Number	Name	Definition	Register Address
1	GND	Ground	-
2	DO1	Digital output 1	1001
3	GND	Ground	-
4	DI3	Digital input 3	1003
5	DI1	Digital input 1	1001
6	GND	Ground	-
7	DO0	Digital output 0	1000
8	GND	Ground	-
9	DI2	Digital input 2	1002
10	Tr.Ig.	True Ignition (TRIG) digital input 0	1000

Digital inputs

All digital inputs use a photo coupler. Current between 0.5 mA and 10 mA activates the coupler. Details for the digital input are:

- High voltage: 5 – 30 VDC @ 0.5 mA minimum, 10 mA sinking maximum
- Low voltage: < 0.8 VDC

This figure describes the digital input circuit:

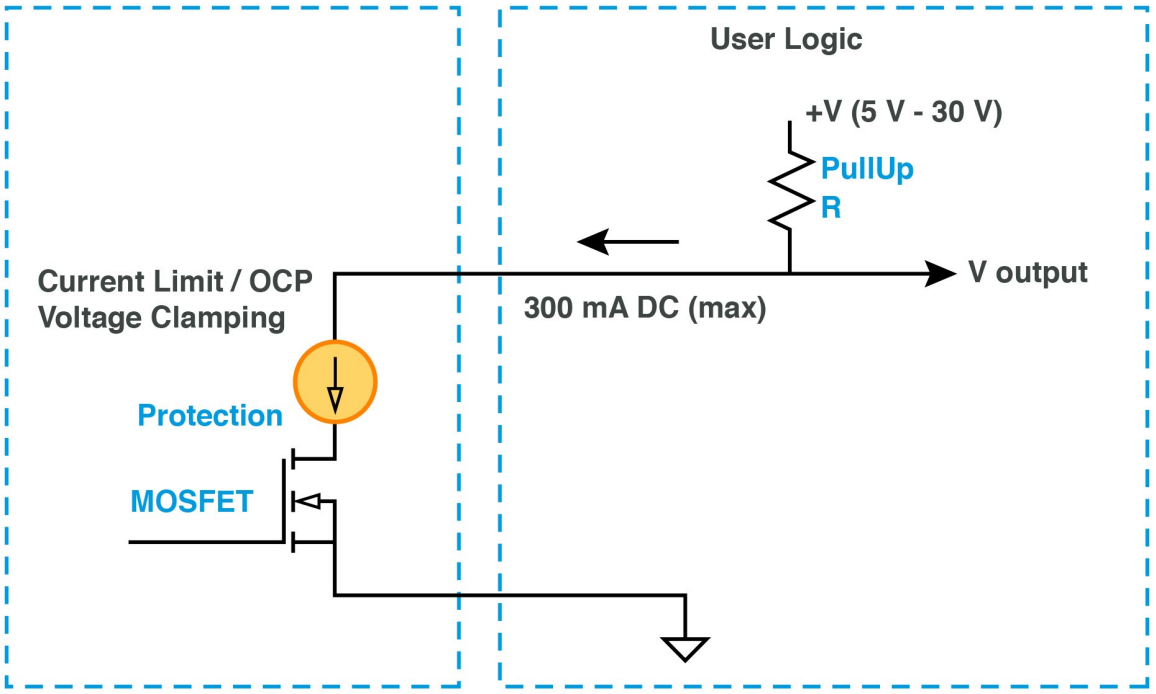


Digital outputs

The digital outputs can drive a device with voltage from 5 – 30 VDC. The output voltage is clamped at 40 VDC. Details for the digital output are:

- High voltage: 5 – 30 VDC sinking
- Low voltage: < 0.8 VDC
- Recommended continuous operating current: 300 mA max
- Current limit: 3.5 A (for short protection)

This figure describes the digital output circuit:



Ground receptacle

The STS has a ground receptacle with nut and lock-washer. See "Connecting power to the STS unit" on page 18.

Maintenance

You can change the battery when required on the STS unit, but it is otherwise maintenance free. The following sections describe this.

Battery replacement

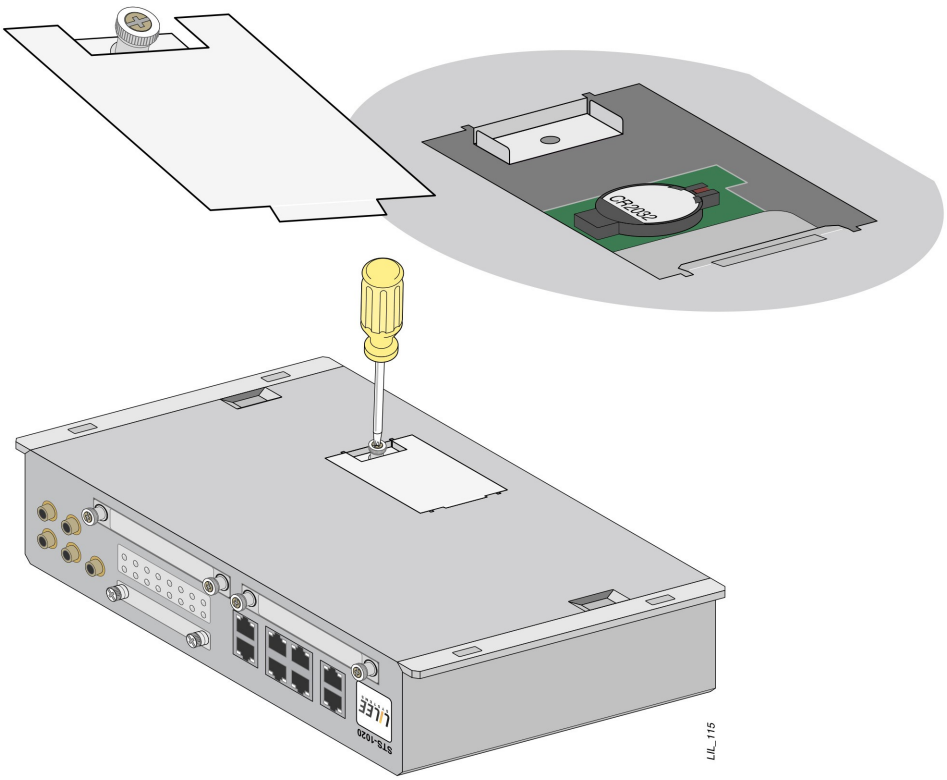
The STS ships with a pre-installed CR2032 lithium ion battery. The battery allows the unit to maintain the accuracy of the real-time clock through power disruptions. Without the battery, any power disruption causes the real-time clock to be reset to the factory default date.

Warning: Use the included battery. Do not use a different battery. Using the wrong type of battery can cause an explosion. Contact LILEE Systems technical support for a battery replacement. CR2032 cells sourced by LILEE Systems may carry a superior temperature rating as compared to CR2032 cells purchased at general retail.

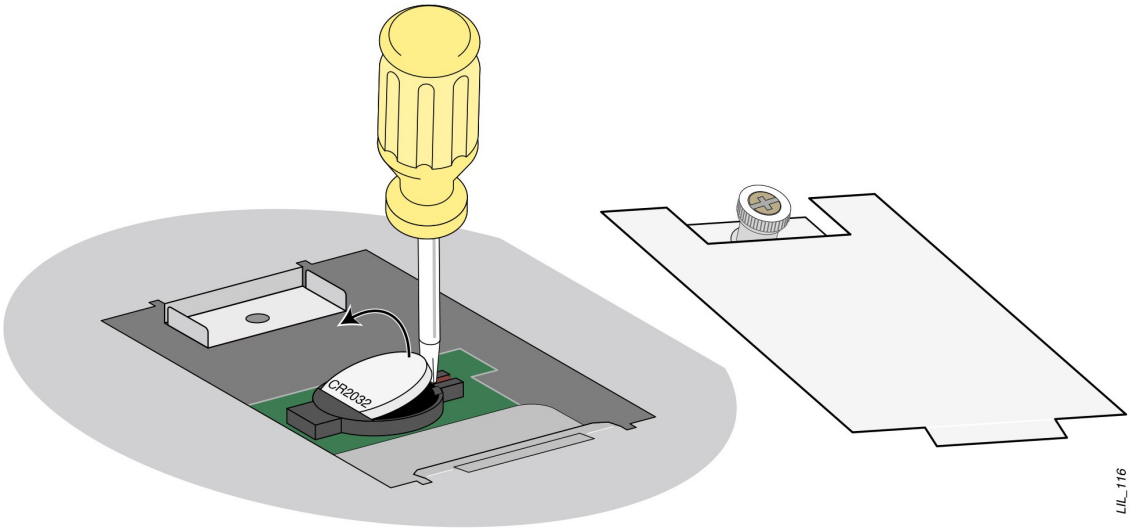
CAUTION: Risk of Explosion if Battery is replaced by an Incorrect Type.
Dispose of Used Batteries According to the Instructions.

To replace the battery, follow these steps:

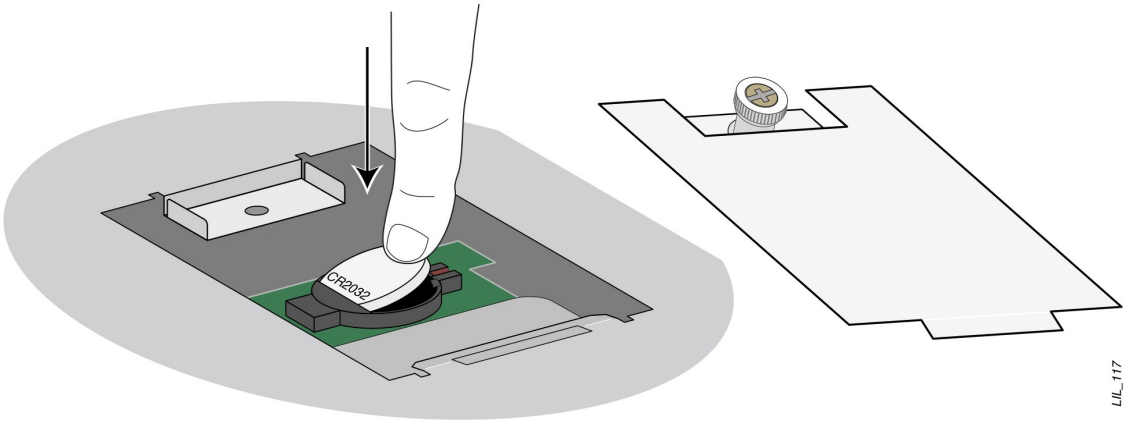
1. Remove the battery compartment door on the bottom of the chassis using a small Phillips screwdriver, as shown below.



2. Remove the existing battery by inserting a small flat-head screwdriver (or something similar) under the battery on the side opposite the retaining lip.



3. Insert the new battery by sliding it under the retaining lip.



4. Press the battery firmly in place. Replace the cover and tighten the screw to secure it.

The battery replacement procedure is complete.

Other maintenance

The STS requires no regular maintenance. Do not open the chassis. Opening the chassis voids the warranty and can cause electric shocks. There are no user-serviceable parts inside the chassis.

If any significant amount of dust, water, or fluid enters the STS, immediately disconnect power and contact your distributor or sales representative.

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