Strato Pi Max User Guide

May 2024

Revision 003

SCMX10XL4A *Strato Pi Max XL with CM4 Wireless, 2GB RAM, Lite*
SCMX10XL4B *Strato Pi Max XL with CM4 Wireless, 4GB RAM, Lite*
SCMX10XL4C *Strato Pi Max XL with CM4 Wireless, 8GB RAM, Lite*
SCMX10XL4F *Strato Pi Max XL with CM4 Wireless, 2GB RAM, 16GB eMMC*
SCMX10XL4G *Strato Pi Max XL with CM4 Wireless, 4GB RAM, 16GB eMMC*
SCMX10XL4H *Strato Pi Max XL with CM4 Wireless, 8GB RAM, 16GB eMMC*
SCMX10XL4K *Strato Pi Max XL with CM4 Wireless, 2GB RAM, 32GB eMMC*
SCMX10XL4L *Strato Pi Max XL with CM4 Wireless, 4GB RAM, 32GB eMMC*
SCMX10XL4M *Strato Pi Max XL with CM4 Wireless, 8GB RAM, 32GB eMMC*
SCMX10XLZA *Strato Pi Max XL with Zymbit SCM4 Wireless, 2GB RAM, 16GB eMMC*
SCMX10XLZB *Strato Pi Max XL with Zymbit SCM4 Wireless, 8GB RAM, 32GB eMMC*

SCMX10XS4A *Strato Pi Max XS with CM4 Wireless, 2GB RAM, Lite*
SCMX10XS4B *Strato Pi Max XS with CM4 Wireless, 4GB RAM, Lite*
SCMX10XS4C *Strato Pi Max XS with CM4 Wireless, 8GB RAM, Lite*
SCMX10XS4F *Strato Pi Max XS with CM4 Wireless, 2GB RAM, 16GB eMMC*
SCMX10XS4G *Strato Pi Max XS with CM4 Wireless, 4GB RAM, 16GB eMMC*
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SCMX10XS4L *Strato Pi Max XS with CM4 Wireless, 4GB RAM, 32GB eMMC*
SCMX10XS4M *Strato Pi Max XS with CM4 Wireless, 8GB RAM, 32GB eMMC*
SCMX10XSZA *Strato Pi Max XS with Zymbit SCM4 Wireless, 2GB RAM, 16GB eMMC*
SCMX10XSZB *Strato Pi Max XS with Zymbit SCM4 Wireless, 8GB RAM, 32GB eMMC*

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Before opening the Strato Pi Max enclosure, disconnect all power sources and any connection to external devices, including USB and Ethernet cables.

Follow all applicable electrical safety standards, guidelines, specifications and regulations for installation, wiring and operations of Strato Pi Max.

Carefully and fully read this Strato Pi Max user guide before installation.

Strato Pi Max is not authorised for use in safety-critical applications where a failure of the product would reasonably be expected to cause personal injury or death. Safety-critical applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Strato Pi Max is neither designed nor intended for use in critical military or aerospace applications or environments and for automotive applications or environment. Customer acknowledges and agrees that any such use of Strato Pi Max is solely at Customer's risk, and that Customer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

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Safety information

Carefully and fully read this user guide before installation and retain it for future reference.

Qualified personnel

The product described in this manual must be operated only by personnel qualified for the specific task and installation environment, in accordance with all relevant documentation and safety instructions. A qualified person should be capable of fully identifying all installation and operation risks and avoid potential hazards when working with this product.

Hazard levels

This manual contains information you must observe to ensure your personal safety and prevent damage to property. Safety information in this manual are highlighted by the safety symbols below, graded according to the degree of danger.

Indicates a hazardous situation which, if not avoided, **will** result in death or serious personal injury.

Indicates a hazardous situation which, if not avoided, **may** result in death or serious personal injury.

Indicates a hazardous situation which, if not avoided, can result in minor or moderate personal injury.

Indicates a situation which, if not avoided, can result in damage of property.

Safety instructions

General safety instructions

Protect the unit against moisture, dirt and any kind of damage during transport, storage and operation. Do not operate the unit outside the specified technical data.

Never open the housing. If not otherwise specified, install in closed housing (e.g. distribution cabinet). Earth the unit at the terminals provided, if existing, for this purpose. Do not obstruct cooling of the unit. Keep out of the reach of children.

WARNING

Life threatening voltages are present within and around an open control cabinet.

When installing this product in a control cabinet or any other areas where dangerous voltages are present, always switch off the power supply to the cabinet or equipment.

WARNING

Risk of fire if not installed and operated properly.

Follow all applicable electrical safety standards, guidelines, specifications and regulations for installation, wiring and operations of this product.

The Compute Module board could generate a substantial amount of heat when the software forces the CPU and/or GPU to operate at high load levels. Ensure that the product is properly installed and ventilated to prevent overheat.

The Strato Pi Max internal power supply could generate a substantial amount oh heat, particularly when subject to a significant amount of electrical load.

An internal fan significantly improves the airflow and heat dissipation. Depending on external environment conditions, the fan could collect a significant amount of dust or other impurities, that could prevent it from spinning or could reduce its effectiveness. Periodically check that the fan is not blocked or partly obstructed.

NOTICE

The connection of expansion devices to this product may damage the product and other connected systems, and may violate safety rules and regulations regarding radio interference and electromagnetic compatibility.

Use only appropriate tools when installing this product. Using excessive force with tools may damage the product, alter its characteristics or degrade its safety.

Battery

Strato Pi Max uses a small lithium non-rechargeable battery to power its internal real time clock (RTC).

Improper handling of lithium batteries can result in an explosion of the batteries and/or release of harmful substances.

Worn-out or defective batteries can compromise the function of this product.

Replace the RTC lithium battery before it is completely discharged. The lithium battery must be replaced only with an identical battery. See the "Replacing the RTC backup battery" section for instructions.

Do not throw lithium batteries into fire, do not solder on the cell body, do not recharge, do not open, do not short-circuit, do not reverse polarity, do not heat above 85°C and protect from direct sunlight, moisture and condensation.

Dispose of used batteries according to local regulations and the battery manufacturer's instructions.

Introduction

Strato Pi Max is an extremely versatile industrial server, based on the Raspberry Pi Compute Module 4, suitable for use in professional and industrial applications where reliability and service continuity are key requirements, and housed in a compact DIN rail case.

Strato Pi Max can be used for an incredible range of applications, from data acquisition and control, to home and building automation, as well as access control, hotel room control solutions, environmental monitoring and many others.

It is available in two versions:

- Strato Pi Max XL, with four expansion slots and housed in a 9 modules DIN rail case
- Strato Pi Max XS, with one expansion slots and housed in a 6 modules DIN rail case.

Both come pre-installed with Raspberry Pi Compute Module 4 or Zymbit Secure Compute Module (SCM).

An optional Compute Module 4 Antenna Kit can be fitted on the top side of the enclosure and internally wired to the Compute Module.

The information contained in this manual covers both Strato Pi Max XL and XS.

This manual generally refers to all products as Strato Pi Max.

STRATO PI MAX XL

STRATO PI MAX XS

Features

Strato Pi Max, all versions:

- ✓ 10-50 Vdc power supply, on pluggable 5.08 mm pitch terminal block, with surge and reverse polarity protection, and 3.3 A resettable fuse
- ✓ voltage and current monitoring of power supply input voltage and current
- ✓ compatible with all versions of Raspberry Pi Compute Module 4, and with Zymbit Secure Compute Module (SCM)
- ✓ one 10/100/1000 and one 10/100 Ethernet port
- ✓ two USB 2.0 type-A ports, with individual power control and fault detection
- ✓ powerful and user-programmable 32 bit Raspberry RP2040 microcontroller based on a dual ARM Cortex-M0+ core clocked at 133 MHz, with 264 kB on-chip SRAM ,16 MB Flash memory and 2 kB SRAM with EEPROM backup. The RP2040 is interconnected to the Raspberry Pi via I²C, USB and UART
- ✓ the Compute Module can control the Reset and Bootsel lines of the RP2040, allowing in-field firmware upgrades, but also development and debugging without external hardware
- ✓ the RP2040 microcontroller handles all housekeeping tasks, including Compute Module watchdog, power management, mass storage boot sequence control and expansion boards detection and control
- ✓ The hardware watchdog independently monitors the Compute Module, and is capable of performing a full power-cycle of the Compute Module. The hardware watchdog can also control the microSD switch matrix, swapping the boot card in case the watchdog is triggered, or disabling the SSD in order to boot from the eMMC or microSD
- ✓ internal fan for active cooling, with configurable automatic activation based on current load and internal temperature
- ✓ temperature sensors for system temperature monitoring
- ✓ highly accurate real time clock with temperature compensated crystal oscillator (TCXO) and replaceable CR1220 Lithium / Manganese Dioxide back-up battery
- ✓ Microchip ATECC608 secure element chip
- ✓ 3-axis accelerometer for motion and tamper detection
- ✓ front panel configurable status LEDs and push-button
- ✓ variable pitch piezoelectric buzzer, for acoustic feedback

Strato Pi Max XL:

- ✓ 4 internal expansion slots. Expansions boards are detected and identified for automatic configuration. They can be individually powered off to save power in stand-by or low power modes
- ✓ flexible mass storage options: eMMC, dual microSD, high performance M.2 PCIe SSD
- ✓ dual microSD card architecture. Strato Pi Max XL routes its two microSD card holders to the Compute Module through a high-speed switching matrix, controlled by the on-board RP2040 microcontroller. Each SD card can be set as the boot card, with the

other available as additional storage. This enables for separate OS/data storage, SD redundancy and in-field full-system upgrades. The microSD slots are hidden, and can be accessed opening the case

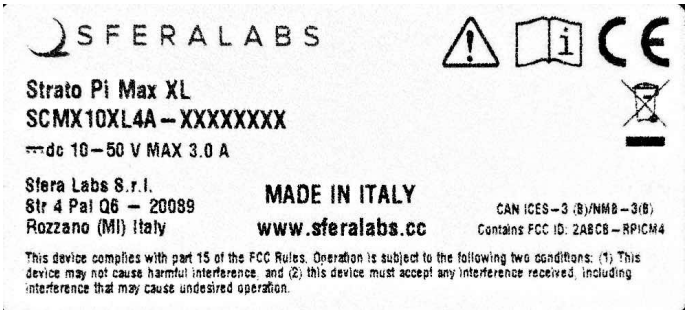
- ✓ 9 modules DIN rail case

Strato Pi Max XS:

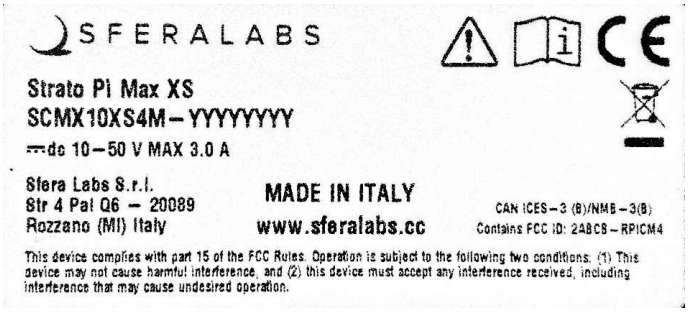
- ✓ 1 internal expansion slot. Installed boards are detected and identified for automatic configuration. Can be powered off to save power in stand-by or low power modes
- ✓ flexible mass storage options: eMMC, high performance M.2 PCIe SSD
- ✓ compact 6 modules DIN rail case

Device identification

The device can be identified with the information provided in the rating and identification plate, permanently attached to the side of the case.



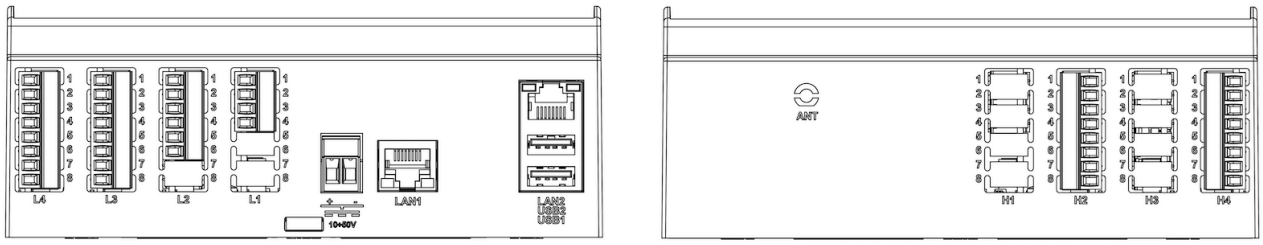
EXAMPLE STRATO PI MAX XL RATING AND IDENTIFICATION PLATE



EXAMPLE STRATO PI MAX XS RATING AND IDENTIFICATION PLATE

Hardware setup

Connections



STRATO PI MAX CONNECTIONS

For the initial set-up, the plastic DIN rail enclosure may have to be removed to access the circuit boards and internal connectors, to install or remove the Compute Module, the microSD cards, the M.2 PCIe SSD, or the expansion boards.

NOTICE

Before opening the Strato Pi Max enclosure, disconnect all power sources and any connection to external devices, including USB and Ethernet cables.

Opening the case

Follow these steps, in the exact order, to open the case:

1. Remove the green pluggable terminal blocks (power supply and expansion boards)
2. Remove the black plastic DIN rail hook
3. With a small flat screwdriver gently separate the case bottom and boards assembly from the top shell; lift both sides gradually; pay attention not to touch the circuit boards with the screwdriver's tip
4. The circuit boards assembly will simply slide out of the case, as it is mechanically held in place by the case bottom only
5. If the optional Compute Module 4 Antenna Kit is installed, disconnect the U.FL connector on the cable to the U.FL-compatible connector on Compute Module before fully separating the circuit board from the case top. Follow the detailed fitting instructions from the Compute Module 4 Antenna Kit product brief document[1].

[1] https://datasheets.raspberrypi.com/cm4/cm4-antenna-kit-product-brief.pdf

Closing the case

6. Remove the front panel. This will help aligning the circuit boards assembly with the case walls
7. If the optional Compute Module 4 Antenna Kit is installed, connect the U.FL connector on the cable to the U.FL-compatible connector on Compute Module
8. Replace the circuit boards assembly inside the case; ensure that the USB and Ethernet connectors and terminal blocks are aligned with the openings in the case
9. Replace the case bottom, partially inserting both sides, then gently push on both sides. The case bottom must perfectly fit and firmly hook to the case cover. If it doesn't, the circuit boards assembly is not perfectly fit into the case top shell
10. Replace the front panel, ensuring that the frontal push-button is aligned to the panel's hole
11. Replace the black plastic DIN rail hook.

OPENING AND CLOSING THE CASE

Compute Module board installation

To install your own Raspberry Pi Compute Module 4 board in Strato Pi Max, or replace a pre-installed board, only a screwdriver is required.

Align the screw holes and connectors of the Compute Module with the Strato Pi Max circuit board and gently snap in the board. Two screws secure the Compute Module to the Strato Pi Max board.

NOTICE

Both the Compute Module and the Strato Pi Max circuit board will likely be damaged if the connectors are not correctly aligned.

NOTICE

Static electricity can damage the components in your system. To protect your system's components from static damage during the installation process, touch any of the unpainted metal surfaces on your computer's frame or wear an ESD wrist strap before handling internal components. Either method will safely discharge static electricity that's naturally present in your body.

When handling the Strato Pi Max circuit board or the Compute Module, be sure to hold it along the side edges using your thumb and index finger. Avoid touching the components and pin connectors as damage can occur.

How to flash the eMMC

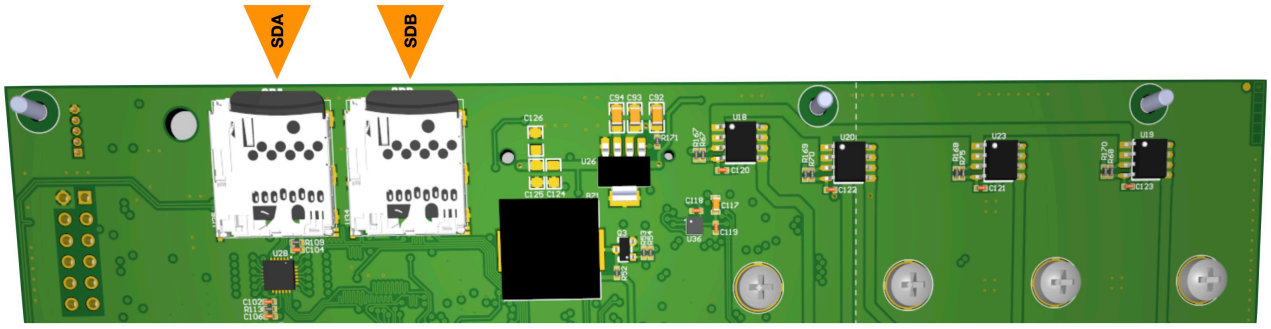
In order to flash the Compute Module's eMMC memory, you can boot the unit from USB[2], access via SSH, and flash the eMMC which will be available as a local mass storage device.

microSD installation

Strato Pi Max XL has two microSD slots to install flash memory cards.

The microSD slots are not directly accessible with the case closed. The slots are located on the bottom side of the main circuit board.

The slots are marked as SDA and SDB.



MICRO SD SLOTS

Replacing the RTC backup battery

Strato Pi Max has a hardware real time clock with a dedicated long-life non-rechargeable back-up battery.

Strato Pi Max is shipped with a **CR1220**[3] Lithium / Manganese Dioxide (Li/MnO2) battery installed.

---

[2] https://www.raspberrypi.com/documentation/computers/raspberry-pi.html#booting-from-usb-mass-storage

[3] BR1220 batteries (Lithium Poly-carbonmonofluoride) can also be used, for improved shelf and service life.

The battery is only used to power the RTC chip when the main power is not available. Depending on operating conditions it should last three or more years[4] if the Strato Pi Max is not powered, or up to the battery's lifetime if it regularly receives external power.

The RTC backup battery holder is on the vertical circuit board, next to the Compute Module area. In the Strato Pi Max, the battery is not accessible from the outside. You should first remove the case body to gain access to the Strato Pi Max circuit boards assembly. Follow the procedure described at the beginning of this chapter to open and replace the case.

WARNING

Improper handling of lithium batteries can result in an explosion of the batteries and/or release of harmful substances.

Worn-out or defective batteries can compromise the function of this product.

KEEP OUT OF REACH OF CHILDREN. Swallowing may lead to serious injury or death in as little as 2 hours due to chemical burns and potential perforation of the esophagus. Immediately see doctor.

Replace the RTC lithium battery before it is completely discharged. Replace the battery every 5 years even if the battery is still working properly. The lithium battery must be replaced only with an identical **CR1220** or **BR1220** battery.

Do not throw lithium batteries into fire, do not solder on the cell body, do not recharge, do not open, do not short-circuit, do not reverse polarity, do not heat above 85°C and protect from direct sunlight, moisture and condensation.

Dispose of used batteries according to local regulations and the battery manufacturer's instructions.

NOTICE

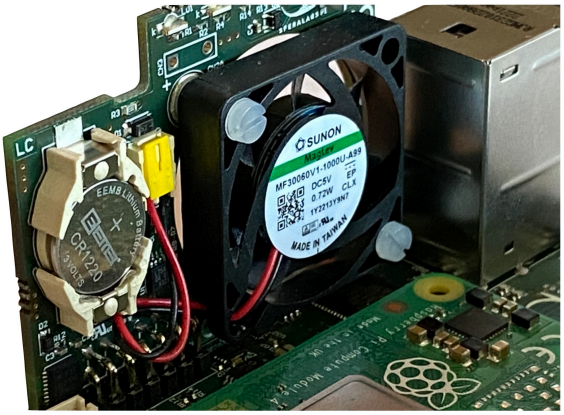
Before opening the Strato Pi Max enclosure, disconnect all power sources and any connection to external devices, including USB cables.

Once the circuit boards assembly is extracted from the enclosure, use a non-conductive pin or small tool to help extract the battery from its holder. Insert the new battery with a gentle push. You don't need tools to insert the battery. The battery is held into place by a spring contact.

Be sure to insert the battery so that the negative (-) terminal is facing the vertical circuit board, and touches the contact pad at the center of the battery holder, as shown in the photo below. Reattach the vertical board to the base; use light torque to tighten the screws.

The real time clock will reset its time immediately when the RTC backup battery is disconnected.

[4] Depending on environmental conditions.



RTC BACKUP BATTERY HOLDER

Terminal blocks

Strato Pi Max has a two-poles 5.08 mm pitch pluggable terminal block for the power supply connection.

The maximum conductor cross section is 3.31 mm² (12 AWG). Recommended stripping length is 7 mm. Screw thread is M3. Never exceed 0.5 Nm torque when tightening the screws.

Power supply

Strato Pi Max can be powered with DC voltage only:

✓ DC: nominal voltage range 10.0 V to 50.0 V, 3 A max input current.

Respect the correct polarity shown in the schematic diagram (+ -). The power supply circuit implements reverse polarity protection using auto resetting fuses and surge protection. The resetting fuse threshold is 3.3 A at 20 C ambient temperature.

The PWR blue LED, visible through the front panel of the DIN-rail case, is lit when power supply is available.

The Strato Pi Max power supply stage is optimised to deliver up to 30W total power through its 5 V main regulator. This regulator supplies all internal voltages.

When the input voltage is below 24 V, if the total power demand is very high, the input current threshold limit could be exceeded, causing the resettable fuse to trip.

PWR LED

The PWR blue LED, visible through the front panel of the DIN-rail case, is lit when power supply is available.

Software installation and configuration

All features of Strato Pi Max can be used with any operating system, programming language or framework compatible with Raspberry Pi.

The following sections describe how to install drivers for the Raspberry Pi OS or to access its features from alternative set-ups.

Raspberry Pi OS Kernel module

The Strato Pi Max Kernel module can be used to easily access all of Strato Pi Max features via a sysfs file system.

Refer to the following instructions to download and install the module or go to:

https://github.com/sfera-labs/strato-pi-max

for updated instructions and further details.

Download and install:

```
$ sudo apt install git raspberrypi-kernel-headers
$ git clone --depth 1 https://github.com/sfera-labs/strato-pi-max-kernel-
module.git
$ cd strato-pi-max-kernel-module
$ make clean
$ make
$ sudo make install
$ dtc -@ -Hepapr -I dts -O dtb -o stratopimax.dtbo stratopimax.dts
$ sudo cp stratopimax.dtbo /boot/overlays/
```

Add the following line to config.txt:

```
dtoverlay=stratopimax
```

Optionally, to be able to use the /sys/ files not as super user, create a new group "stratopimax" and set it as the module owner group by adding an udev rule:

```
$ sudo groupadd stratopimax
$ sudo cp 99-stratopimax.rules /etc/udev/rules.d/
```

and add your user to the group, e.g., for user "pi":

```
$ sudo usermod -a -G stratopimax pi
```

Reboot:

```
$ sudo reboot
```

You will find all the available devices under the directory /sys/class/stratopimax/ and you will be able to control all the exposed functionalities by simply reading/writing the corresponding files from your application or any tool or framework that supports file access.

Refer to the next chapter for usage details about each functionality.

Raspberry Pi OS Real Time Clock installation

The RTC is based on the NXP PCF2131 RTC module and is connected to the Raspberry Pi via its I²C serial bus.

Refer to the following instructions to download and install the module or go to:

https://github.com/sfera-labs/rtc-pcf2131

for updated instructions.

Download and install:

```
$ sudo apt install git raspberrypi-kernel-headers
$ git clone --depth 1 https://github.com/sfera-labs/rtc-pcf2131
$ cd rtc-pcf2131
$ make clean
$ make
$ sudo make install
$ dtc -@ -Hepapr -I dts -O dtb -o rtc-pcf2131.dtbo rtc-pcf2131.dts
$ sudo cp rtc-pcf2131.dtbo /boot/overlays/
```

Add the following line to config.txt:

```
dtoverlay=rtc-pcf2131
```

Reboot:

```
$ sudo reboot
```

Alternative set-up

If you are using other Operating Systems or need not to use the provided drivers, you can access all the functionalities of Strato Pi Max via dedicated GPIO pins, the I²C bus and the SPI interface.

All the features directly controlled via GPIO can be accessed using any of the standard methods provided by the operating system or any available library for your programming language or framework of choice.

Make sure the GPIO pins are correctly configured as inputs or outputs, depending on the function and no pull-up/pull-down is enabled.

All features of Strato Pi Max controlled via I²C are accessible on bus 1 ("i2c-1" - GPIO2/SDA1 and GPIO3/SCL1) while SPI devices are connected to SPI0 ("spi0.x" - GPIO9-11).

Refer to the block diagram for more details.

Using Strato Pi Max

Most of the features discussed in this chapter are based on features implemented on our firmware code running on the RP2040 microcontroller.

The microcontroller can be programmed with user developed custom firmware, that could replace the factory installed version. Refer to the "RP2040 firmware upload and programming" chapter below for more details.

The RP2040 microcontroller firmware implements critical logic and checks to ensure safe and reliable operations of Strato Pi Max including, but not limited to, fan thresholds setup for heat dissipation, watchdog, microSD switch matrix control, mass storage boot sequence control, power distribution voltages, currents and internal temperature monitoring.

In order to develop a safe and reliable custom firmware, you should be fully aware of the internal hardware architecture of Strato Pi Max, and of all safety and control requirements needed for your application and installation constraints.

Real Time Clock

Strato Pi Max has a hardware real time clock with a dedicated long-life non-rechargeable back-up battery.

Once the RTC driver is properly installed, you will simply use the date and time commands to control the hardware clock.

The RTC chip is connected to the CM's I²C bus.

SD matrix

Strato Pi Max XL implements a flexible dual microSD card architecture.

Strato Pi Max XL routes its two microSD card holders to the Compute Module through a high-speed switching matrix, controlled by the on-board microcontroller. Each SD card can be set as the boot card, with the other available as additional storage.

This enables for separate OS/data storage, SD redundancy and in-field full-system upgrades.

The BCM2711 in the Raspberry Pi Compute Module supports two SD card interfaces, SD (main) and SD1 (secondary).

The first (SD) is a proprietary Broadcom controller that does not support SDIO and is the primary interface used to boot and talk to the eMMC or SDX signals.

The second interface (SD1) is standards compliant and can interface to SD, SDIO and eMMC devices.

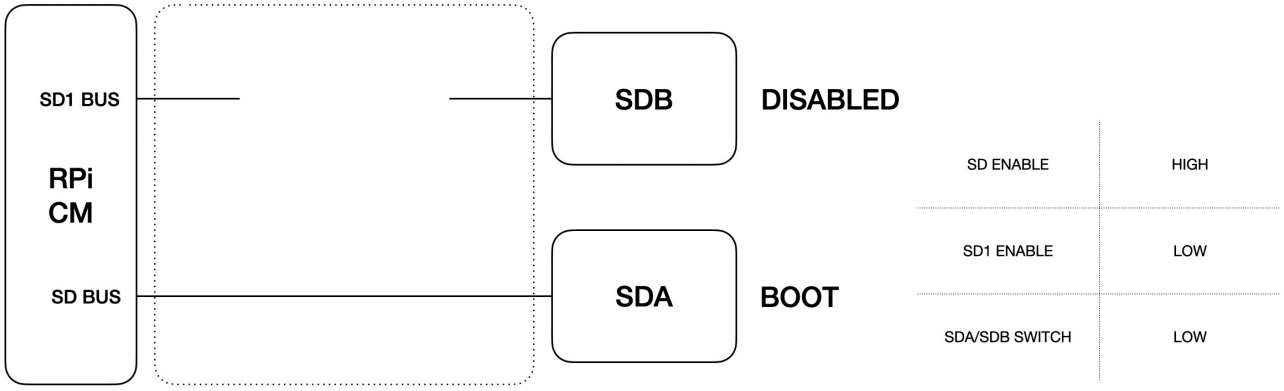
Both interfaces can support speeds up to 50MHz single ended (SD High Speed Mode), and this speed is supported by the Strato Pi Max SD matrix as well.

Strato Pi Max XL has two microSD slots, called SDA and SDB, and the SD matrix allows 2x2 connections between both SD/SD1 interfaces and the SDA/SDB slots.

NOTICE

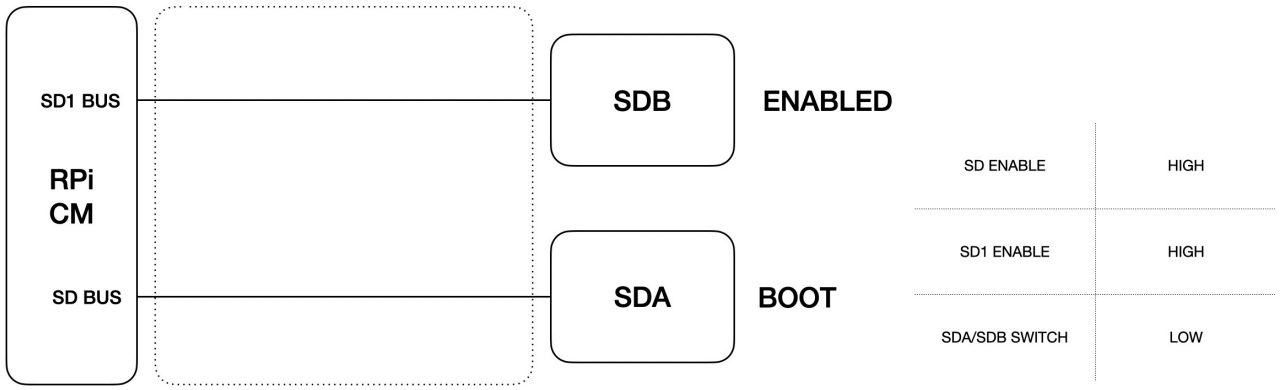
Disconnecting an SD card from the Compute Module's SD interfaces when partitions from the card are mounted at the operating system level, can result in file system and data corruption. The Strato Pi Max XL matrix and the microcontroller don't check for card usage and don't provide any safety mechanism to prevent improper disconnection of the SD cards.

The matrix is controlled by the Strato Pi Max XL RP2040 microcontroller and can be configured using the microcontroller I²C registers and the Strato Pi Max kernel driver for Linux. The matrix has a hardware default configuration so that, when at power-up all microcontroller lines are high-impedance, it has a stable configuration, with SD connected to SDA and SD1 not connected. When the microcontroller is reset, even if the control lines change state, the matrix control logic will retain the current configuration.



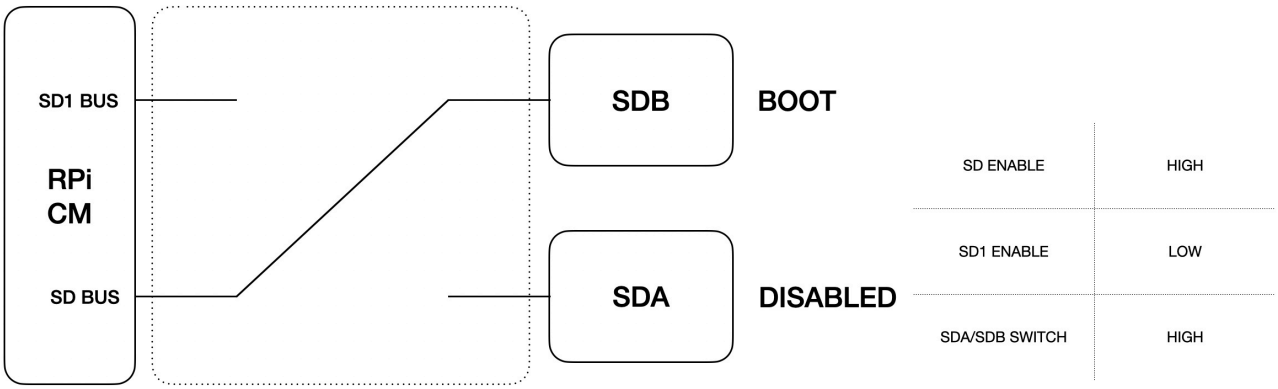
SD MATRIX DEFAULT CONFIGURATION

With SDA used as the boot card, SDB can be connected to the SD1 interface, and used as additional storage.



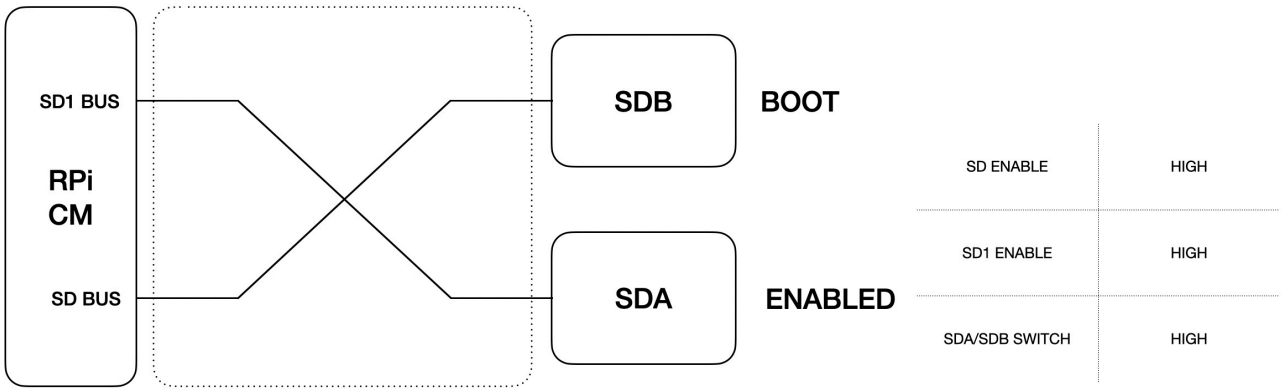
SD MATRIX BOOT FROM SDA AND SDB ENABLED FOR ADDITIONAL STORAGE

The SD interface can be connected to SDB instead of SDA, so that boot will be done from SDB.



SD MATRIX BOOT FROM SDB

Finally, with the SD interface connected to SDB for boot, the SDA slot can be enabled to be used for additional storage.



SD MATRIX BOOT FROM SDB AND SDA ENABLED FOR ADDITIONAL STORAGE

It is also possible to disable both the SD and SD1 interfaces. This configuration could be used with the Compute Module versions that have the embedded eMMC storage or the M.2 PCIe SSD, when no external SD card is needed.

USB ports power management

Strato Pi Max has two external USB ports, USB1 (bottom) and USB2 (top), and one additional internal port.

These ports are individually controlled by the MIC2076, a power distribution controller with circuit protection. The MIC2076 is internally current limited and has thermal shutdown that protects the device and load (0.5A max). A fault status output flag is asserted during over-current and thermal shutdown conditions.

The power-enable inputs and the fault status outputs are routed to the RP2040 IO expander lines to easily control and monitor connected USB devices from your application.

The USB ports are powered down during controlled power cycles (see below).

ATECC608 secure element

Strato Pi Max embeds the ATECC608A or ATECC608B (depending on production lot) secure element chip from Microchip. The ATECC608 is connected to the Raspberry Pi Compute Module via the I²C bus (default address: 0x60).

Its key features are:

- ✓ Cryptographic co-processor with secure hardware-based key storage
- ✓ Protected storage for up to 16 Keys, certificates or data
- ✓ Hardware support for asymmetric sign, verify, key agreement – ECDSA: FIPS186-3 Elliptic Curve Digital Signature
    - ✓ ECDH: FIPS SP800-56A Elliptic Curve Diffie-Hellman
    - ✓ NIST standard P256 elliptic curve support
- ✓ Hardware support for symmetric algorithms
    - ✓ SHA-256 & HMAC hash including off-chip context save/restore
    - ✓ AES-128: encrypt/decrypt, Galois field multiply for GCM
- ✓ Networking key management support
    - ✓ Turnkey PRF/HKDF calculation for TLS 1.2 & 1.3
    - ✓ Ephemeral key generation and key agreement in SRAM – Small message encryption with keys entirely protected
- ✓ Secure boot support
    - ✓ Full ECDSA code signature validation, optional stored digest/signature – optional communication key disablement prior to secure boot
    - ✓ Encryption/Authentication for messages to prevent on-board attacks
- ✓ Internal high-quality FIPS 800-90 A/B/C Random Number Generator (RNG)
- ✓ Two high-endurance monotonic counters
- ✓ Guaranteed unique 72-bit serial number.

EERAM

Strato Pi Max has a Microchip 47L16 16 Kbit SRAM with EEPROM Backup. This chip combines the persistent storage characteristics of a traditional EEPROM, without the limitations in terms of number of erase cycles. It is connected to the RP2040 I²C bus.

Push button

Strato Pi Max has a user-configurable push button on the front panel. It is routed to the RP2040 IO expander lines to easily control it from your application.

ACT and USR LEDs

The red and green ACT LEDs replicate the LEDs of the Raspberry Pi 4 Model B.

Under Linux the green LED will flash to signify eMMC access.

If any error occurs during booting, then this LED will flash an error pattern which can be decoded using the look up table on the Raspberry Pi website.

The red ACT LED replicates the red power LED on the Raspberry Pi 4 Model B.

The red and green USR LEDs are controlled by the RP2040 firmware and can be configured by the user.

Power supply

The power supply input voltage and current are monitored by the RP2040 and accessible to the user.

Note that, when Strato Pi Max is being powered by the UPS battery connected to the UPS expansion board, the reported input voltage has a value close to zero, while the current value represents the current drawn from the battery.

The RP2040 can be configured to enable a delayed power cycle. The timing and behaviour of the power cycle procedure are controlled by several configuration parameters.

After being powered off, Strato Pi Max will supply power to the Compute Module only when the main power source is restored (the power-up mode parameter can change this behaviour, so that Strato Pi Max will always power up the Compute Module after a power cycle, even when powered by the UPS battery). A power-up delay can be configured so that the CM is powered up only when the main power source has been stable for the specified time.

Hardware watchdog

Strato Pi Max implements a dedicated hardware watchdog circuit that can be used to perform a power cycle of the Raspberry Pi Compute Module.

The watchdog can also swap the SD cards or switch on/off the PCIe disk after one or more consecutive watchdog timeouts, to automatically recover from disks failures.

Watchdog default behaviour is described below, but all timing parameters and control logic can be modified through the I²C control registers and sysfs files.

The watchdog is normally disabled. When enabled you should send I²C requests to the watchdog status register (heartbeat signal) faster than every 60 seconds.

If the RP2040 doesn't see such request for more than 60 seconds, it will wait up to 60 seconds more and, if not started by the CM, it will initiate a shutdown procedure, i.e. wait 60 seconds more, then power cycle the Raspberry Pi Compute Module (removing all power supply sources to the Compute Module, and at the same time pulling the RUN line low).

Internal fan and temperature sensors

Strato Pi Max has an internal fan to improve heat dissipation inside its DIN-rail enclosure, particularly in the area of the power regulators, where most of the heat is generated.

A temperature sensor, located on the vertical circuit board, can be used to monitor the current temperature.

In the factory default configuration, Strato Pi Max automatically starts the fan when the internal temperature reaches 55 °C and stops when temperature falls below 50 °C.

3-axis accelerometer

Strato Pi Max embeds the IIS2DLPC high-performance three-axis linear accelerometer with digital I²C interface connected to the RP2040 I²C bus. The IIS2DLPC has user selectable full scales of ±2g/±4g/±8g/±16g and is capable of measuring accelerations with output data rates from 1.6 Hz to 1600 Hz.

The accelerometer can be used as a tamper detection sensor, triggered when the Strato Pi Max case is moved or tilted, as well as for other motion-related applications, like vibration monitoring and impact recognition.

Advanced usage

Compute Module I²C bus addresses

The following table lists all components connected to the Compute Module I²C bus, and their R/W addresses.

P/N	ID	ADDR	WRITE	READ
LM75ADP	VU1	0x48 [1001000]	0x90	0x91
PCF2131	VU2	0x53 [01010011]	0xA6	0xA7
ATECC608	BU30	0x60 [1100000]	0xC0	0xC1
RP2040 (slave)	BU14	0x35 [0110101]	0x6A	0x6B

The expansion boards may use additional addresses on the Compute Module I²C bus.

RP2040 I²C bus addresses

The following table lists all components connected to the RP2040 I²C bus, and their R/W addresses.

P/N	ID	ADDR	WRITE	READ
47L16	BU31	0x50 [1010000] - SRAM	0xA0	0xA1
		0x18 [0011000] - Control Register	0x30	0x31
IIS2DLPC	BU36	0x19 [0011001]	0x32	0x33
MCP23009	BU17	0x20 [100000]	0x40	0x41
MCP23009	BU21	0x21 [100001]	0x42	0x43
MCP23009	BU22	0x22 [100010]	0x44	0x45
I/O EXP slot 1		0x24 [100100]	0x48	0x49
I/O EXP slot 2		0x25 [100101]	0x4A	0x4B
I/O EXP slot 3		0x26 [100110]	0x4C	0x4D
I/O EXP slot 4		0x27 [100111]	0x4E	0x4F

The expansion boards may use additional addresses on the RP2040 I²C bus.

I²C Configuration and control registers map

The following paragraphs list the available control and configuration registers available at address 0x35 on the I2C1 bus.

If expansion boards are installed, additional registers will be available: registers 100-124 are reserved for the expansion board in slot 1, registers 125-149 for slot 2, registers 150-174 for slot 3, and registers 175-199 for slot 4.

Refer to the user guide of the specific expansion board for details about its registers.

The data payload of write requests have the following structure:

VALUE LSB	...	VALUE MSB	OPTIONAL MASK LSB	...	OPTIONAL MASK MSB	CRC

The data payload of read responses have the following structure:

VALUE LSB	...	VALUE MSB	CRC

Registers containing values that span on multiple bytes store the least significant byte (LSB) in the first byte (byte 0) and the most significant one (MSB) in the last byte.

Write requests on registers containing multiple fields can include an optional mask value (same length of the register bytes) to specify which bits of the register shall be written.

The CRC byte value is calculated using a CRC-8 function with polynomial $x^8 + x^5 + x^3 + x^2 + x + 1$ (i.e. 0x2F) and initial value of 0xFF. The function is applied starting with the register's address number, followed by the value bytes and the optional mask bytes from least to most significant.

In the following, registers or bits within are marked with the following access attributes:

R: readable

W: writable

C: clearable, i.e. can be set to zero only

FIRMWARE VERSION

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	MAJOR								MINOR							

Register 1 (R)

Bit 7-0 **MINOR**: minor version of the installed firmware

Bit 15-8 **MAJOR**: major version of the installed firmware

CONFIGURATION COMMANDS

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5	KEY								CMD							
6					ERR	BUSY	FAIL	OK	CMD							

Register 5 (W)

Bit 15-8 **KEY**: set to 0x2A

Bit 7-0 **CMD**: command

2 = Restore factory default configuration

3 = Save current configuration to be retained across power cycles.
Affected values are highlighted in *italic* in the following tables

Register 6 (R)

Result of command written to register 5

Bit 7-0 **CMD**: processed command

Bit 8 **OK**: set to 1 when command successfully terminated

Bit 9 **FAIL**: set to 1 when command failed

Bit 10 **BUSY**: set to 1 when command being executed

Bit 11 **ERR**: set to 1 when invalid values are written in command register

BUTTON

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
14	CNT															ST

Register 14 (R)

Bit 0 **ST**: Button state

0 = not pressed

1 = pressed

Bit 15-8 **CNT**: Button presses counter

BUZZER

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
17	*T ON*															
18	*T OFF*															
19	*REPS*															
20	*TONE*															

Register 17 (RW)

Bit 15-0 ***T ON***: Buzzer cycle ON time in milliseconds, applied when REPS is written

Register 18 (RW)

Bit 15-0 ***T OFF***: Buzzer cycle OFF time in milliseconds, applied when REPS is written

Register 19 (RW)

Bit 15-0 ***REPS***: Buzzer cycle repetitions, cycle starts when written. Set to zero to repeat indefinitely

Register 20 (RW)

Bit 15-0 ***TONE***: Buzzer tone in Hz

GREEN LED

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
22	*T ON*															
23	*T OFF*															
24	*REPS*															

Register 22 (RW)

Bit 15-0 ***T ON***: LED cycle ON time in milliseconds, applied when REPS is written

Register 23 (RW)

Bit 15-0 ***T OFF***: LED cycle OFF time in milliseconds, applied when REPS is written

Register 24 (RW)

Bit 15-0 ***REPS***: LED cycle repetitions, cycle starts when written. Set to zero to repeat indefinitely

RED LED

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
26	*T ON*															
27	*T OFF*															
28	*REPS*															

Register 26 (RW)

Bit 15-0 ***T ON***: LED cycle ON time in milliseconds, applied when REPS is written

Register 27 (RW)

Bit 15-0 ***T OFF***: LED cycle OFF time in milliseconds, applied when REPS is written

Register 28 (RW)

Bit 15-0 ***REPS***: LED cycle repetitions, cycle starts when written. Set to zero to repeat indefinitely

EXPANSION BOARDS

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
31													*EN4*	*EN3*	*EN2*	*EN1*
32									TYPE1							
33									TYPE2							
34									TYPE3							
35									TYPE4							

Register 31 (RW)

Bit 0, …, 3 ***ENn***: Expansion board *n* control

0 = disabled

1 = enabled

Register 32, …, 35 (R)

Bit 8-0 **TYPE*n***: Expansion board *n* type

2 = Uninterruptible Power Supply

3 = CAN and dual RS-485

4 = RS-232 and RS-485

5 = Industrial digital I/O

SD CARD SWITCH

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
39											STAT	DEF	SD1 RST	*SD1 EN*	SD RST	*SD EN*

Register 39 (RW)

Bit 0 ***SD EN***: SD bus (main SD) control

0 = disabled

1 = enabled (default)

Bit 1 **SD RST**: SD bus (main SD) reset control

0 = disabled (default)

1 = reset ***SD EN*** to enabled upon power cycle

Bit 2 ***SD1 EN***: SD1 bus (secondary SD) control

0 = disabled (default)

1 = enabled

Bit 3 **SD1 RST**: SD1 bus (secondary SD) reset control

0 = disabled (default)

1 = reset ***SD1 EN*** to disabled upon power cycle

Bit 4 **DEF**: power-up default routing

0 = SD bus routed to SDA and SD1 bus to SDB (default)

1 = SD bus routed to SDB and SD1 bus to SDA

Bit 5 **STAT**: current SD routing

0 = SD bus routed to SDA and SD1 bus to SDB

1 = SD bus routed to SDB and SD1 bus to SDA

PCIE

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
42														DEF		EN

Register 42 (RW)

Bit 0 **EN**: PCIe control

0 = disabled

1 = enabled (default)

Bit 2 **DEF**: power-up default

0 = disabled

1 = enabled (default)

USB PORTS

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
42							ERR2	*EN2*							ERR1	*EN1*

Register 42

Bit 0 (RW) ***EN1***: USB1 control

0 = disabled

1 = enabled (default)

Bit 1 (R) **ERR1**: USB1 fault

0 = OK

1 = fault

Bit 8 (RW) ***EN2***: USB2 control

0 = disabled

1 = enabled (default)

Bit 9 (R) **ERR2**: USB2 fault

0 = OK

1 = fault

WATCHDOG

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
48														EXP		*EN*
49	*TIMEOUT*															
50	*DOWN DELAY*															
51	*SD SWITCH*															
52	*PCIE PWR*															

Register 48

A read or write request to this register updates the watchdog heartbeat.

Bit 0 (RW) ***EN***: enable control

0 = watchdog disabled (default)

1 = watchdog enabled

Bit 2 (R) **EXP**: timeout state

0 = watchdog timeout not expired

1 = watchdog timeout expired

Register 49 (RW)

Bit 15-0 ***TIMEOUT***: heartbeat timeout, in seconds (default = 60)

Register 50 (RW)

Bit 15-0 ***DOWN DELAY***: forced power cycle delay after timeout expiration, in seconds (default = 60)

Register 51 (RW)

Bit 15-0 ***SD SWITCH***: SD switch control after power cycle triggered by watchdog

0 = SD switch disabled (default)

N > 0 = switch SDA/SDB after N consecutive watchdog resets, if no heartbeat is detected. It requires the watchdog being enabled (**EN** = 1) in the saved configuration

Register 52 (RW)

Bit 15-0 ***PCIE PWR***: PCIe power control after power cycle triggered by watchdog

0 = PCIe power control disabled (default)

N > 0 = switch PCIe power state after N consecutive watchdog resets, if no heartbeat is detected. It requires the watchdog being enabled (**EN** = 1) in the saved configuration

POWER CYCLE

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
56													PCIE	SD	*UM*	EN
57	*DOWN DELAY*															
58	*OFF TIME*															
59	*UP DELAY*															

Register 56 (RW)

Bit 0 **EN**: power cycle control

0 = disabled (default)

1 = enabled

Bit 1 ***UM***: up mode

0 = main power: if the shutdown occurs when the main power is not present, the whole Strato Pi Max is powered down after the shutdown wait time, and powered up again only when the main power is restored (default)

1 = always: available only if UPS expansion board installed - if the shutdown occurs when the main power is not present, only the Compute Module and

the other expansion boards are turned off. The power is always restored after the power-off time, even if running on battery, with no main power present

Bit 2 **SD**: SD switch

0 = SD switch at power cycle disabled (default)

1 = switch SDA/SDB at every power cycle

Bit 3 **PCIE**: PCIe power

0 = PCIe power state switch at power cycle disabled (default)

1 = switch PCIe power state at every power cycle

Register 57 (RW)

Bit 15-0 ***DOWN DELAY***: shutdown delay from the moment it is enabled, in seconds (default = 60)

Register 58 (RW)

Bit 15-0 ***OFF TIME***: duration of power-off, in seconds (default = 5)

Register 59 (RW)

Bit 15-0 ***UP DELAY***: power-up delay after main power is restored, in seconds (default = 0)

POWER MONITORING

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
63	VIN V															
64	VIN I															

Register 63 (R)

Bit 15-0 **VIN V**: voltage measured on power supply input, in mV

Register 64 (R)

Bit 15-0 **VIN I**: current drain measured on power supply input, in mA

ACCELEROMETER

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
68	X															
69	Y															
70	Z															

Register 68 (R)

Bit 15-0 **X**: x-axis acceleration (resolution: 14-bit, full scale: ±2 g)

Register 69 (R)

Bit 15-0 **Y**: y-axis acceleration (resolution: 14-bit, full scale: ±2 g)

Register 70 (R)

Bit 15-0 **Z**: y-axis acceleration (resolution: 14-bit, full scale: ±2 g)

SYSTEM ERRORS

ADDR	BYTE 1								BYTE 0							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
74				UPS	ACC	IO EXP	USB		SPI	I2C SLV	I2C MSTR		CFG	RP RST	RP	STUP
75										EXP4	EXP3	EXP2	EXP1	BU22	BU21	BU17

The registers' bits are set to 1 when the corresponding error occurs and reset to 0 only when cleared by the user.

Register 74 (RC)

Bit 0 **STUP**: system setup failure

Bit 1 **RP**: RP2040 failure

Bit 2 **RP RST**: RP2040 reset occurred

Bit 3 **CFG**: user configuration loading error

Bit 5 **I2C MSTR**: RP2040 I2C master failure

Bit 6 **I2C SLV**: RP2040 I2C slave failure

Bit 7 **SPI**: RP2040 SPI failure

Bit 9 **USB**: USB ports fault

Bit 10 **IO EXP**: I/O expanders fault (see register 75)

Bit 11 **ACC**: accelerometer fault

Bit 12 **UPS**: UPS fault

Register 75 (RC)

Bit 0 **BU17**: I/O expander BU17 fault

Bit 1 **BU21**: I/O expander BU21 fault

Bit 2 **BU22**: I/O expander BU22 fault

Bit 3 **EXP1**: I/O expander on expansion board in slot 1 fault

Bit 4 **EXP2**: I/O expander on expansion board in slot 2 fault

Bit 5 **EXP3**: I/O expander on expansion board in slot 3 fault

Bit 6 **EXP4**: I/O expander on expansion board in slot 4 fault

RP2040 firmware upload and programming

WARNING

The RP2040 microcontroller firmware implements critical logic and checks to ensure safe and reliable operations of Strato Pi Max including, but not limited to, fan thresholds setup for heat dissipation, watchdog, microSD switch matrix control, mass storage boot sequence control, power distribution voltages, currents and internal temperature monitoring.

In order to develop a safe and reliable custom firmware, you should be fully aware of the internal hardware architecture of Strato Pi Max, and of all safety and control requirements needed for your application and installation constraints.

You can download the latest version of the standard firmware here:

https://www.sferalabs.cc/files/stratopimax/fw/latest/strato_pi_max.uf2

To load a .uf2 firmware file to the RP2040 simply reset it in boot mode using the RP_RUN_C and RP_BOOTSEL_C lines connected to GPIO20 and GPIO21 of the CM respectively. The RP2040 will appear as a USB storage device (/dev/sdXX) which can be mounted as a standard disk. After copying the .uf2 file to the disk the RP2040 will reset and run the newly loaded firmware.

Thermal considerations for Strato Pi Max

The Raspberry Pi Compute Module draws power and generates heat proportionally to CPU and GPU load.

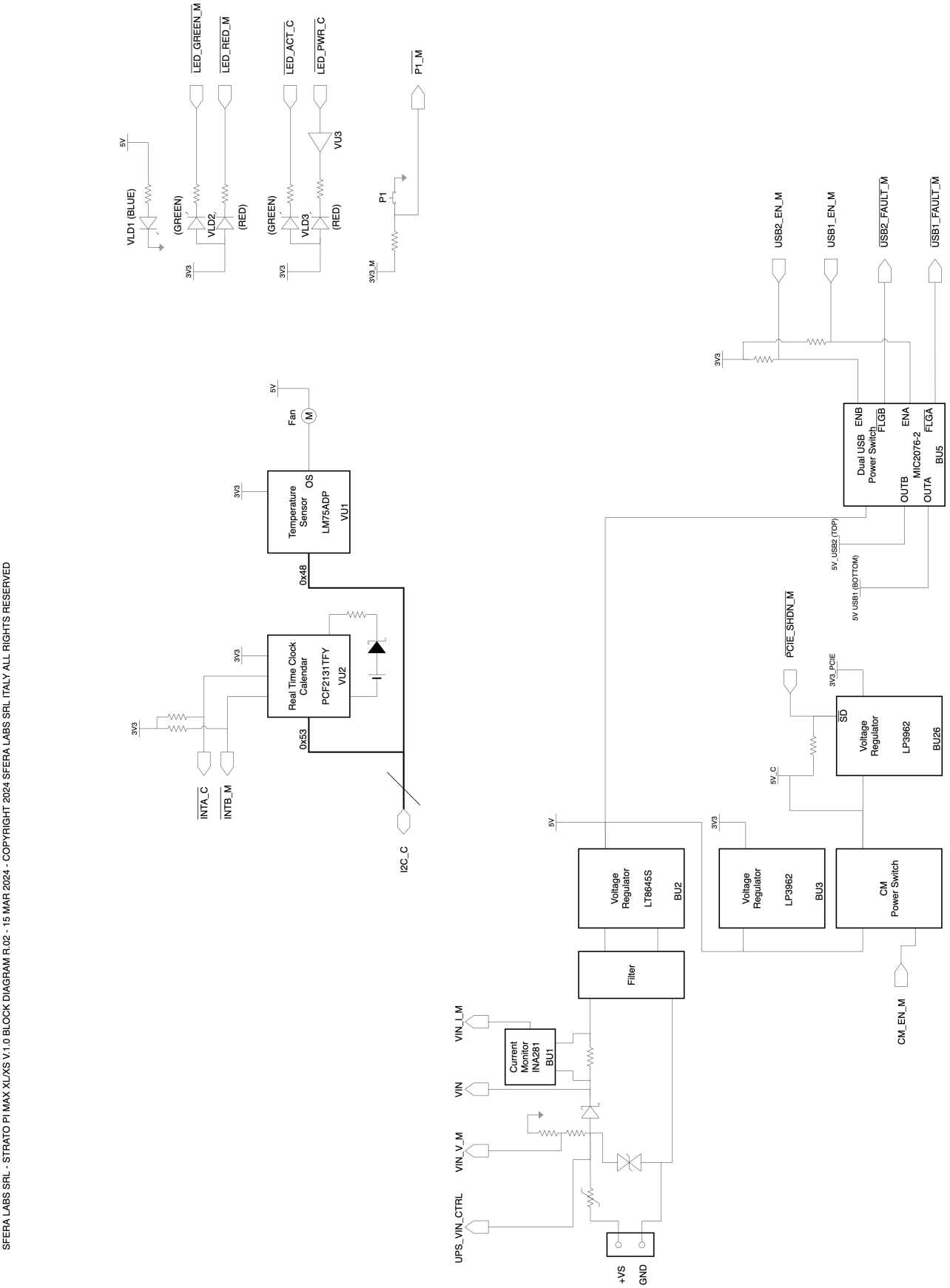
The Strato Pi Max main regulator, battery charger and VSO regulator also generate a substantial heat proportionally to the total amount of current that has to be supplied to the Pi and, if present, external devices.

The thermal behaviour of Strato Pi Max is dynamic and affected by operating conditions and the external environment temperature.

The Raspberry Pi CPU has the ability to throttle down its clock speed once a certain core temperature is reached. This prevents CPU overheating, also limiting the temperature inside the enclosure, when the CPU load is high for a significant amount of time.

An internal fan, directly overhead the Compute Module and voltage regulators area of the main circuit board, plays an important role keeping the temperature inside the enclosure to reasonable levels, even under heavy electrical load conditions. The fan starts only when temperature or power draw exceeds preset levels. See the "Internal fan and temperature sensors" chapter above for additional details.

Block diagram



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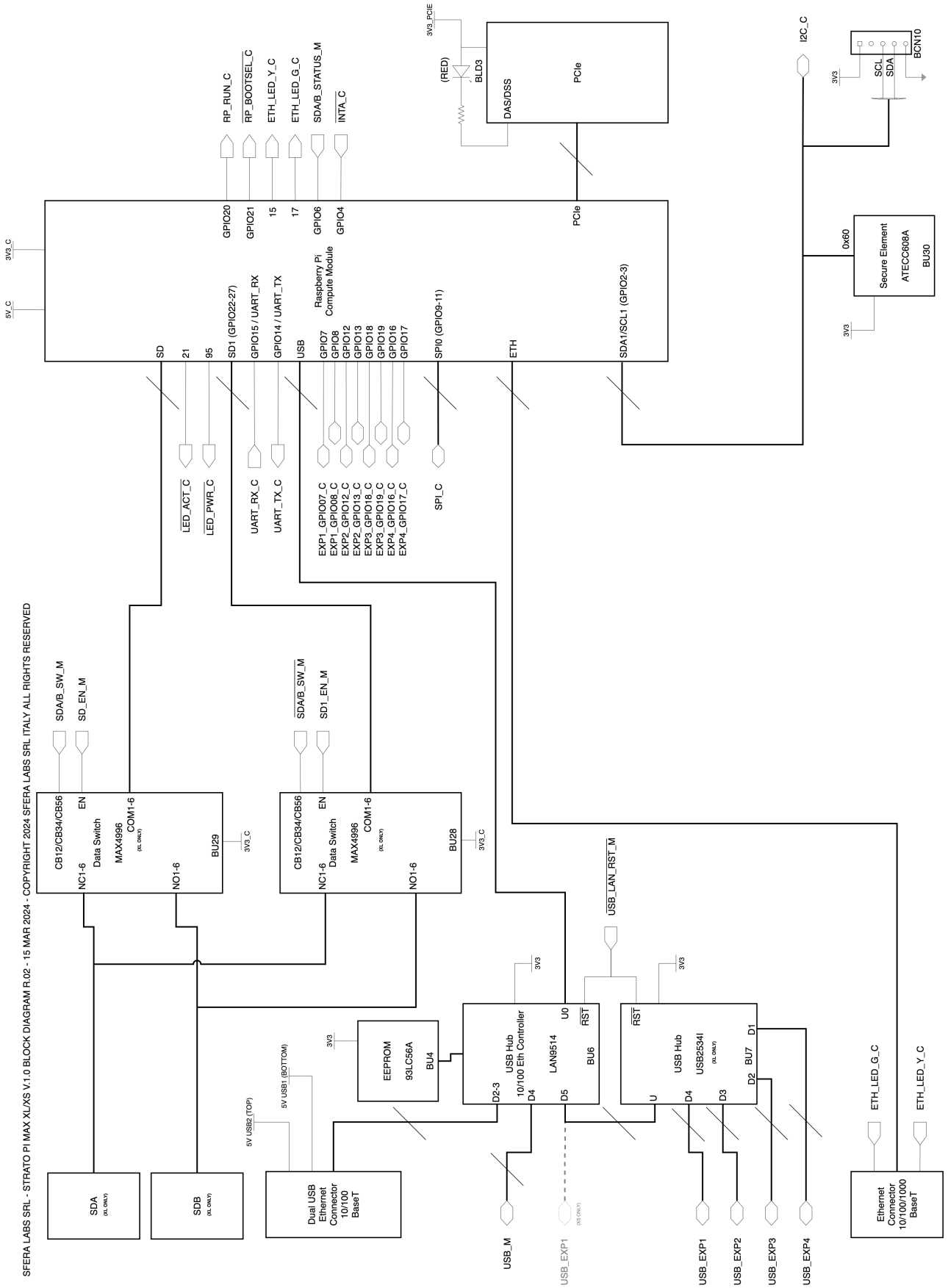
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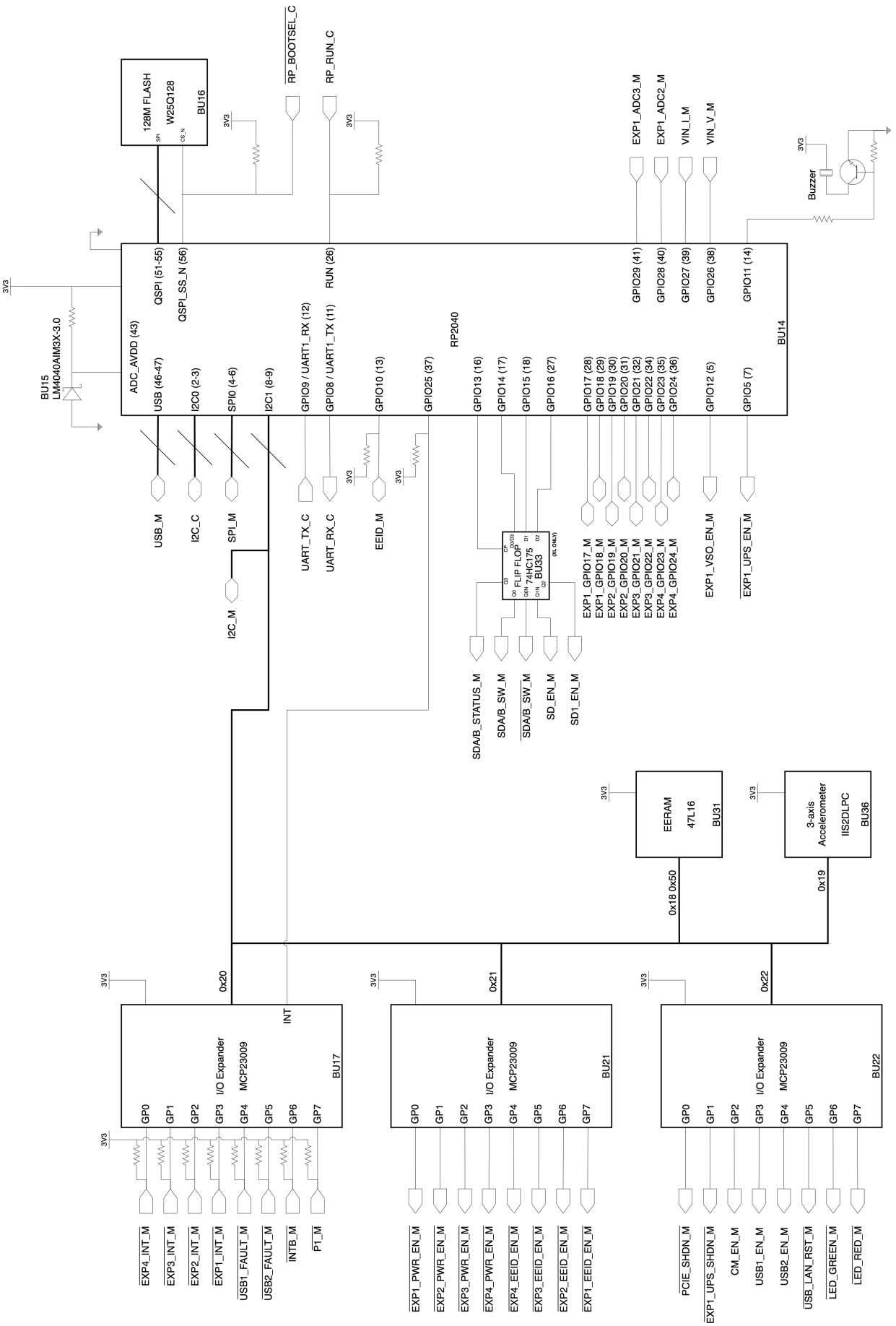
Raspberry Pi Compute Module
SD
SD1 (GPIO22-27)
USB
SPI0 (GPIO9-11)
ETH
SDA1/SCL1 (GPIO2-3)
PCIe
3V3_C
5V_C
RP_RUN_C
RP_BOOTSEL_C
ETH_LED_Y_C
ETH_LED_G_C
SDA/B_STATUS_M
INTA_C
GPIO20
GPIO21
15
17
GPIO6
GPIO4
3V3_PCIE
(RED)
BLD3
DAS/DSS
I2C_C
SCL
SDA
BCN10
0x60
Secure Element
ATECC608A
BU30
LED_ACT_C
LED_PWR_C
UART_RX_C
UART_TX_C
SPI_C
CB12/CB34/CB56
NC1-6
EN
Data Switch
MAX4996
COM1-6
NO1-6
BU29
BU28
SDA/B_SW_M
SD_EN_M
SD1_EN_M
USB_LAN_RST_M
EEPROM
93LC56A
BU4
USB Hub
10/100 Eth Controller
LAN9514
BU6
USB2534I
BU7
Dual USB
Ethernet
Connector
10/100
BaseT
5V USB2 (TOP)
5V USB1 (BOTTOM)
SDA
SDB
USB_M
USB_EXP1
USB_EXP2
USB_EXP3
USB_EXP4
Ethernet
Connector
10/100/1000
BaseT



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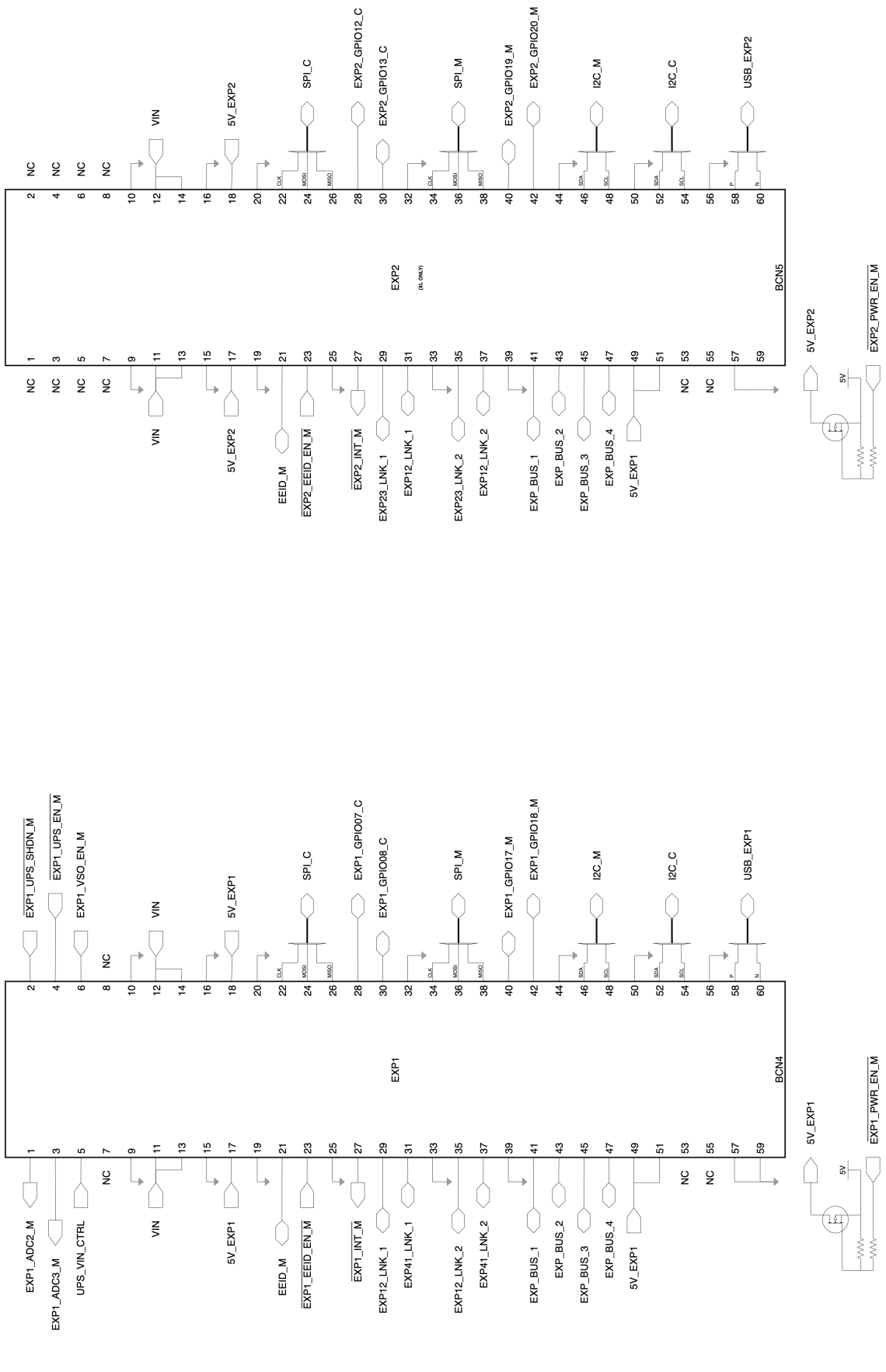

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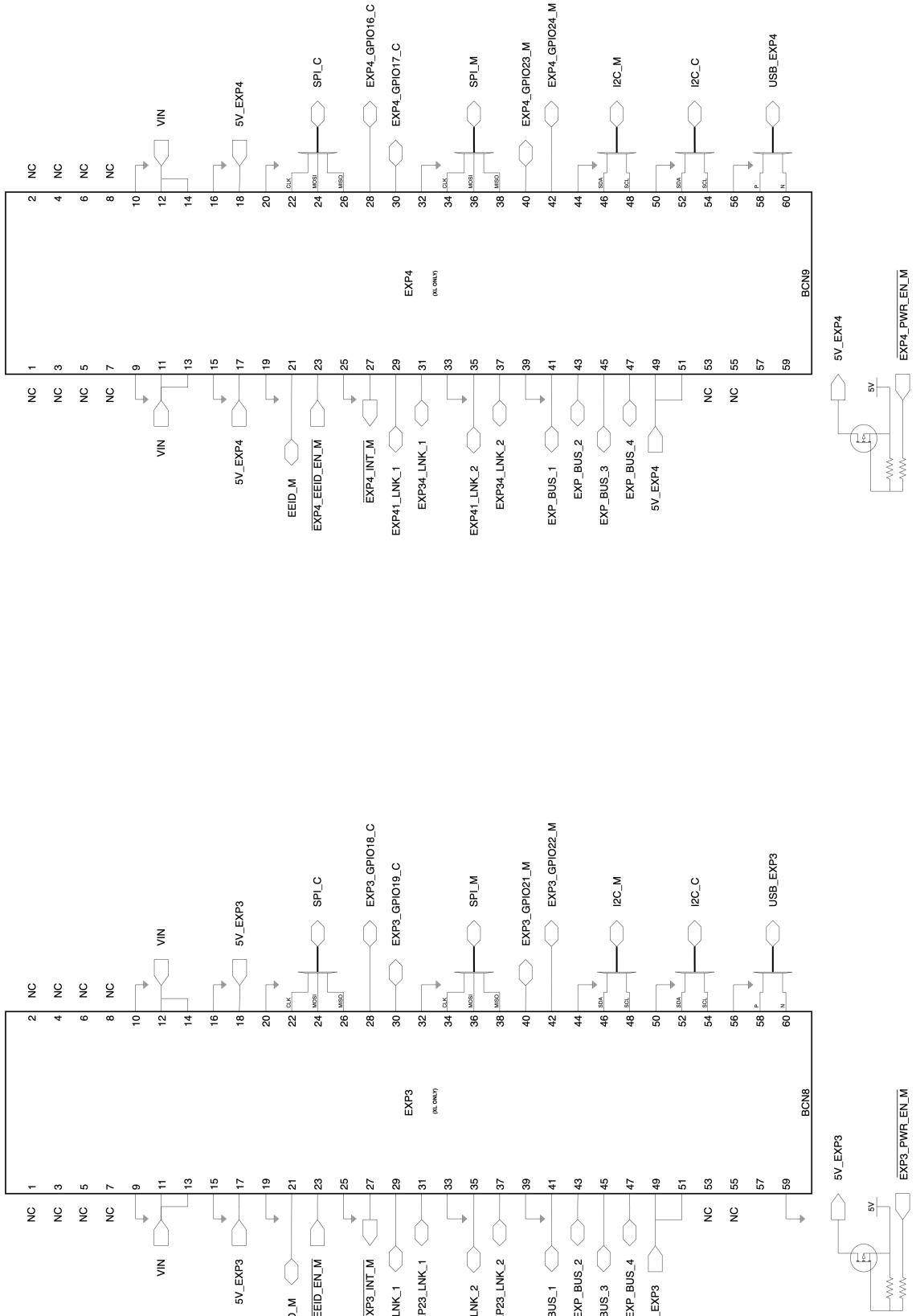

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Technical specifications

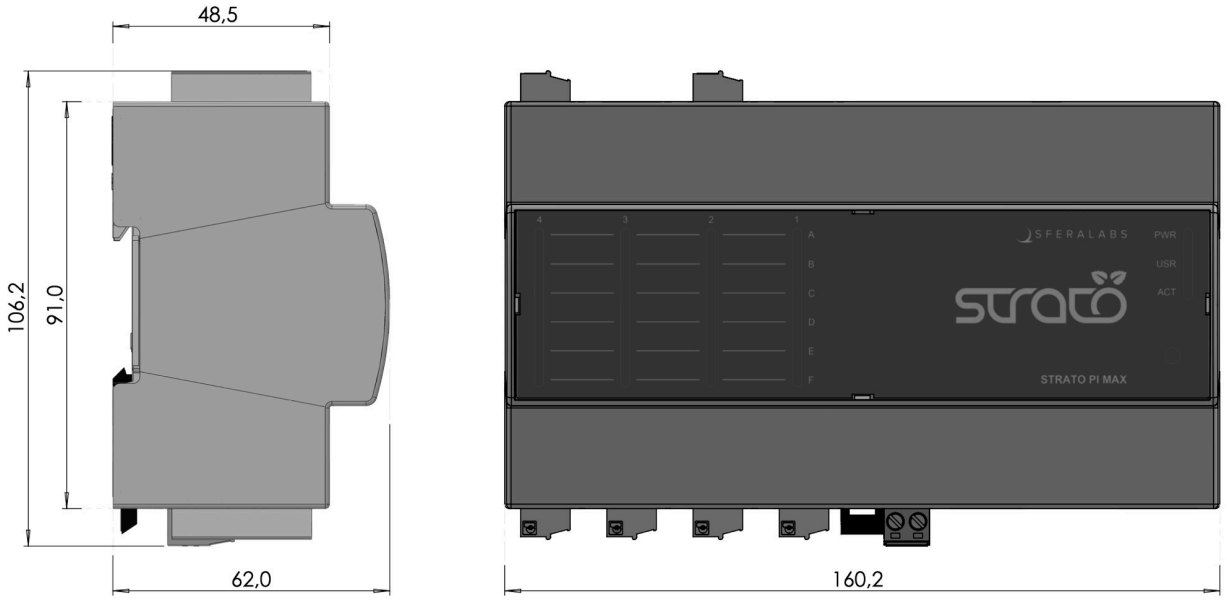
Note: all values typical, at +25 °C and under normal operating conditions.

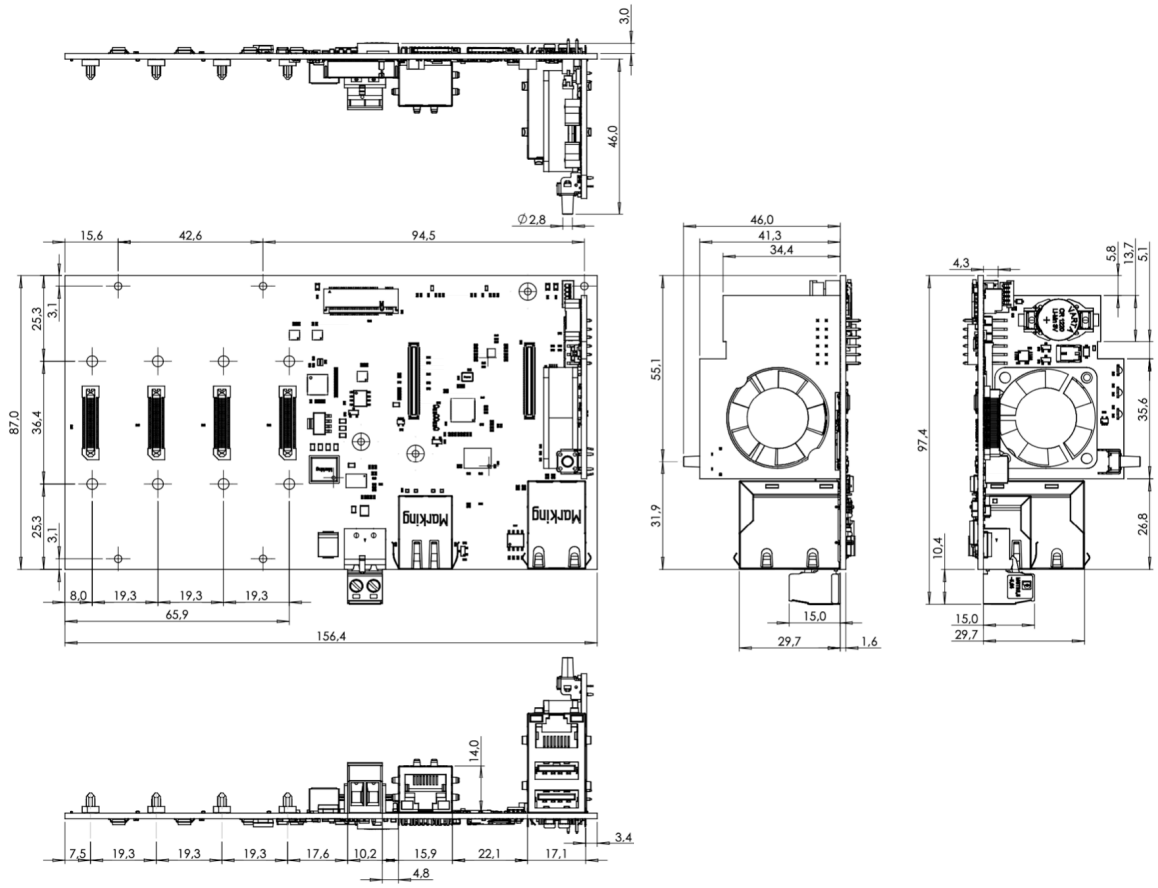
POWER SUPPLY	
Power supply operating voltage (VS)	⎓dc 24 V nominal (range 10-50 V), max 3.0 A. An absolute maximum input voltage of 60 V is tolerated, with reduced surge protection Reverse polarity and surge protection with 3.3 A resettable fuse
Current consumption at VS+ 12 V⎓ including Raspberry Pi CM 4, with GB Ethernet connected, M.2 PCIe SSD, no USB devices, no UPS expansion board	low CPU load: 0.37 A, 100% CPU load, before throttling: 0.51 A
Current consumption at VS+ 24 V⎓ including Raspberry Pi CM 4, with GB Ethernet connected, M.2 PCIe SSD, no USB devices, no UPS expansion board	low CPU load: 0.19 A, 100% CPU load, before throttling: 0.28 A
Current consumption at VS+ 24 V⎓ including Raspberry Pi CM 4, with GB Ethernet connected, M.2 PCIe SSD, no USB devices, UPS expansion board, VSO on 8 W, UPS enabled, battery charging	low CPU load: 0.9 A
USB1 port output current	500 mA (Max)
USB2 port output current	500 mA (Max)
RASPBERRY PI COMPATIBILITY	
Raspberry platform compatibility	Raspberry Pi Compute Module 4 Zymbit SCM4
EXPANSION SLOTS	
Sfera Labs X2	1 slot, Strato Pi Max XS 4 slots, Strato Pi Max XL
PCIe	M.2 form factor 2242
REAL TIME CLOCK	
Oscillator frequency	32768 kHz
Frequency Tolerance	±3 ppm
Backup battery	Only use CR1220 or BR1220 Lithium / Manganese Dioxide (Li/MnO2) batteries. Expected battery life without main power supply: 3 or more years, depending on environmental conditions
EERAM	
Capacity	16 Kbit (2048 x 8 bits)

SRAM r/w cycles	Infinite
EEPROM store cycles	> 1000000
Data retention	> 200 years
ACCELEROMETER	
Range	±2g/±4g/±8g/±16g full scale
Data rates	from 1.6 Hz to 1600 Hz
Bandwidth	up to 800 Hz
INTERNAL TEMPERATURE SENSORS	
Temperature accuracy	±2 °C
Resolution	11 bits (0.125 °C)
INTERNAL POWER SUPPLY VOLTAGE SENSOR	
Voltage range	0…58 V
Total Unadjusted Error (TUE)	±2.5 % of full-scale
Resolution	12 bits (8.7 RP2040 ENOB)
INTERNAL POWER SUPPLY CURRENT SENSOR	
Current range	0…4 A
Total Unadjusted Error (TUE)	±2.5 % of full-scale
Resolution	12 bits (8.7 RP2040 ENOB)
EMI IMMUNITY STANDARDS	
Electromagnetic immunity compliance	EN 61000-4-2: 2009 (ESD) EN 61000-4-3: 2020 (Radiated RF Field) EN 61000-4-4: 2012 (Burst/fast transient) EN 61000-4-5: 2014 / A1: 2017 (Surge) EN 61000-4-6: 2014 / AC: 2015 (Conducted) EN 61000-4-8: 2010 (Power freq. magnetic field)
ENVIRONMENTAL	
Operating temperature	-20…+60 °C
Storage temperature	-30…+80 °C
Altitude	Up to 2000 m
Humidity	5% to 95% RH noncondensing
Protection degree	IP20
MECHANICAL	
5.08 mm pitch terminal block characteristics (power supply)	Maximum conductor cross section: 3.3 mm2 (12AWG) Recommended stripping length: 7 mm Screw thread: M3 Maximum screws tightening torque: 0.5 Nm

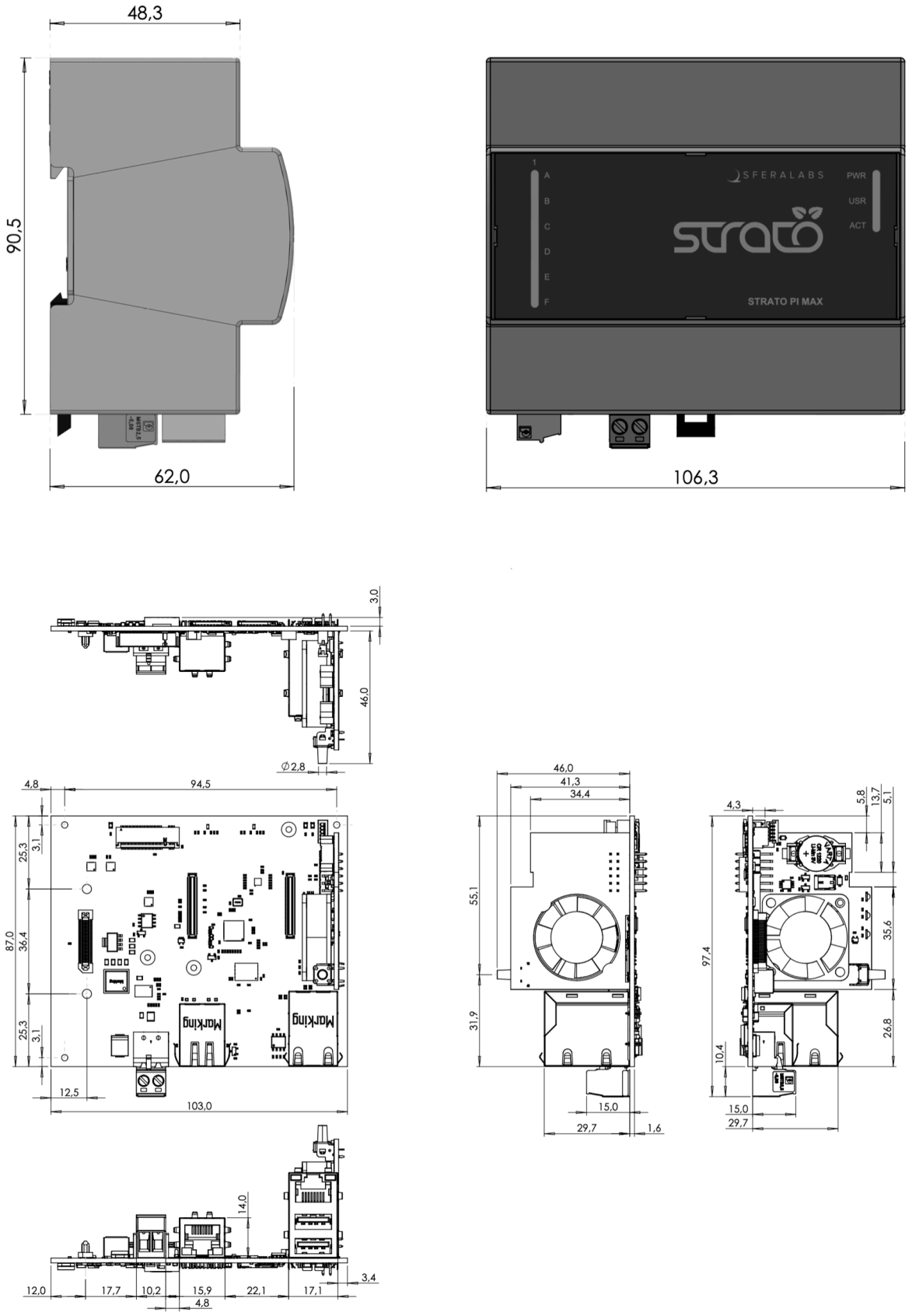
Dimensions, Strato Pi Max XL	9 module Din Rail enclosure width: 160.2 mm height: 91.0 mm depth: 62.0 mm
Dimensions, Strato Pi Max XS	6 module Din Rail enclosure width: 106.3 mm height: 90.5 mm depth: 62.0 mm
Weight, Strato Pi Max XL	260 g (including Raspberry Pi Compute Module, M.2 PCIe SSD; not including expansion boards, Compute Module 4 Antenna Kit)
Weight, Strato Pi Max XS	190 g (including Raspberry Pi Compute Module, M.2 PCIe SSD; not including expansion board, Compute Module 4 Antenna Kit)

Dimensions





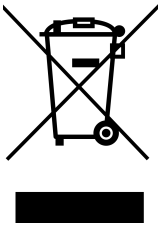
STRATO PI MAX XL DIMENSIONS (mm)



STRATO PI MAX XS DIMENSIONS (mm)

Disposal

Waste Electrical & Electronic Equipment



(Applicable in the European Union and other European countries with separate collection systems). This marking on the product, accessories or literature indicates that the product should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources. Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

Strato Pi Max contains a small non rechargeable manganese dioxide lithium coin battery.

In the Strato Pi Max, the battery is not accessible from the outside. You should first remove the case body to gain access to the Strato Pi Max circuit boards. Always remove the battery before disposing of this product.

Installation and use restrictions

Standards and regulations

The design and the setting up of electrical systems must be performed according to the relevant standards, guidelines, specifications and regulations of the relevant country. The installation, configuration and programming of the devices must be carried out by trained personnel.

The installation and wiring of connected devices must be performed according to the recommendations of the manufacturers (reported on the specific data sheet of the product) and according to the applicable standards.

All the relevant safety regulations, e.g. accident prevention regulations, law on technical work equipment, must also be observed.

Safety instructions

Carefully read the safety information section at the beginning of this document.

Set-up

For the first installation of the device proceed according to the following procedure:

- ✓ make sure all power supplies are disconnected
- ✓ install and wire the device according to the schematic diagrams on the specific product user guide
- ✓ after completing the previous steps, switch on the power supply and other related circuits.

Conformity Information

EU

This device complies with the following applicable European Community harmonised standards:

- ✓ 2014/30/EU - Electromagnetic Compatibility Directive (EMC)
- ✓ 2011/65/EU and 2015/863/EU - Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 3)

The following harmonised standards have been used to demonstrate conformity to these directives:

- ✓ EN61000-6-2:2019 - EMC Immunity standard for industrial environments
- ✓ EN61000-6-3:2021 - EMC Emission standard for residential, commercial and light-industrial environments

The declaration of conformity is available at: https://www.sferalabs.cc

USA

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Shielded cables must be used with this equipment to maintain compliance with FCC regulations.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CANADA

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

RCM AUSTRALIA / NEW ZEALAND

This product meets the requirements of the standard EN 61000-6-3: 2021 - Emission for residential, commercial and light-industrial environments.

Compliance information for Raspberry Pi CM4

Strato Pi Max contain a standard Raspberry Pi Compute Module 4 single board computer. These boards have a WiFi and Bluetooth radio module. They are user accessible and replaceable.

EU

The Raspberry Pi Compute Module 4 is in conformity with the essential requirements and other relevant requirements of the Radio Equipment Directive 2014/53/EU.

USA

Raspberry Pi Compute Module 4 FCC IDENTIFIER: **2ABCB-RPICM4**

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be colocated or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multitransmitter product guidelines. This (WiFi DTS) device has 20 MHz bandwidth mode.

CANADA

Raspberry Pi Compute Module 4 IC CERTIFICATION No.: **20953-RPICM4**

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.