



nSynC Product Family Reference Manual

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Abstract

This document describes the nSynC product line (formally known as LAVASynC), designed for select USB-C mobile devices which use a USB-C receptacle for charging and data.

The nSynC products permit the mobile device to access USB accessories while being charged.

This product's mode of operation charges your mobile device battery to 100% as long as external power is attached. This mode of operation supports Docking Detect, which ensures the mobile device enters the correct state during a "hot connect" to the LAVA product.

This document describes the connectors and configuration options for the nSynC product line.

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Introduction

The nSynC product line allows USB 2.0 peripherals to be attached to a mobile device, while permitting simultaneous battery charging.

No software needs to be installed on the mobile device in order to use the LAVA product.

The nSynC product is connected to a mobile device using a standard USB-C to USB-C cable provided by the user. The USB-C cable **must support both data and charging**. The cable may be up to 1.5 meters (5 feet) in length. The cable need not be electronically marked, as the current levels are always less than 3 amperes.

The core products are powered using a standard 5V USB power supply, such as the charging brick supplied with the mobile device.

The “vc” products can operate from a 9 to 36 VDC unregulated power supply. This power option is ideal in vehicle-based applications or any standalone unit running from a storage battery. In a retail or business environment, this option permits the power brick to be placed a considerable distance away from the product while using a thin power cable.

The Power-over-Ethernet (PoE) products require a suitable Network Switch with PoE support. A non-PoE Network Switch can use a PoE Power Injector for each port to operate with a LAVA PoE-capable product. A PoE Power Injector is a standard add-on available from many Network Switch vendors.

The nSynC products only function with select USB-C mobile devices. These devices must implement specific aspects of the USB-C Power Delivery (USB-C PD) specification. For a complete list of tested mobile devices, please check the LAVA compatibility list. The link for this list is located on each product page.

For mobile devices using a USB-C receptacle for data and power, please contact LAVA Sales or Technical support.

nSynC Product Family

All members of the nSynC Product Family provide the same core functionality of allowing USB peripherals to be attached to a mobile device while permitting simultaneous battery charging.

nSynC Product Family Overview						
Product	USB 2.0 Ports [Type A]	Ethernet Adapter	Power over Ethernet	5 VDC Input [USB-C]	9/36 VDC Input [Barrel]	Description
nSynC-P2UE	2	YES	YES	Auxiliary [Micro-B]	-	2-port USB Hub & Ethernet Adapter with PoE
nSynC-PE	-	YES	YES	Auxiliary [Micro-B]	-	Ethernet Adapter with PoE
nSynC-2UE	2	YES	-	YES	-	2-port USB Hub & Ethernet Adapter
nSynC-vc2UE	2	YES	-	-	YES	2-port USB Hub & Ethernet Adapter
nSynC-E	-	YES	-	YES	-	Ethernet Adapter
nSynC-vcE	-	YES	-	-	YES	Ethernet Adapter
nSynC-3U	3	-	-	YES	-	3-port USB Hub
nSynC-vc3U	3	-	-	Auxiliary	YES	3-port USB Hub
nSynC-1U	1	-	-	YES	-	1-port USB Hub
nSynC-vc1U	1	-	-	Auxiliary	YES	1-port USB Hub
nSynC-1U-OEM	1	-	-	YES	-	1-port OEM Adapter (board only)

The “vc” products can operate from a 9 to 36 VDC unregulated power supply via a DC Barrel Jack with a 2.1 mm positive center pin.

The optional 5 VDC inputs on the PoE products are labeled “Aux 5V Input”.

Product Operation

Overview

The nSynC products contain the following core features:

- ❑ USB Host operation with simultaneous mobile device charging
- ❑ Up to three USB-2.0 receptacles
- ❑ Wired networking (10/100 Ethernet) support
- ❑ Option for Power over Ethernet (PoE) support
- ❑ Option to be powered from standard USB Power Adapters
- ❑ Option to be powered from any regulated 5-volt power supply
- ❑ Option to be powered from a 12- or 24-volt unregulated DC power source

The product's mode of operation charges a mobile device battery to 100% as long as external power is attached. This product supports Docking Detect, which ensures the mobile device enters the correct state during a "hot connect" to the LAVA adapter.

The nSynC products require no mobile device software or configuration.

The core products are powered using a standard 5V USB power supply, such as the charging brick supplied with the mobile device. The "vc" products can operate from a 9 to 36 VDC unregulated power supply, which drives both the mobile device and USB accessories. The PoE-capable products derive power from the network cable.

USB accessories can be attached at any time.

LAVA products do not draw power from the mobile device if the external power source is removed.

The attached USB accessories do not function when external power is removed.

***Note:** If your use case requires USB accessories to be operated with and without an external power source, please contact LAVA Sales as other LAVA products not described in this document are designed for this situation.*

USB Host Operation with Simultaneous Mobile Device Charging

nSynC products allow the charging of select USB-C mobile devices while interacting with USB accessories. The LAVA products do not draw power from the mobile device and only allow USB accessory operation while being powered by an external power source.

The compatible mobile devices have been verified to support USB Host operation while also allowing the device to be charged. LAVA calls this feature SimulCharge, for simultaneous charging while working with USB accessories. The USB-C specification allows for many levels of functionality to be implemented by each manufacturer. Not all aspects of USB-C and USB-C PD (Power Delivery) are implemented on a device just because it has a USB-C receptacle. The System Requirements section states which mobile devices have been tested for the ability to employ SimulCharge.

USB 2.0 Ports for User Accessories

The LAVA products include an internal USB 2.0 Hub, which is used to connect integrated and user-supplied USB accessories. Up to three user-accessible USB 2.0 ports are available depending on which LAVA product is selected.

User accessories are attached to USB 2.0 ports with a standard A-type receptacle. Each receptacle provides power to each USB Accessory up to a maximum of 500 mA, as per the USB specification. The power supply used must have sufficient capacity for the mobile device, LAVA hardware, and USB accessories.

A LAVA product must be powered for a USB-A receptacle to function. The LAVA products have a dedicated power input and are not intended to draw power from the tablet or mobile phone they are connected to.

A power budget must be developed for a system to handle additional USB accessories and the related cables. Power loss in each cable results in lower voltages at each device. Using self-powered USB Hubs may be required in some systems to offload the power supply responsible for the tablet or mobile phone.

Wired Network Operation

Many nSynC products provide a 10/100 Fast Ethernet wired interface. This feature relies on standard support from the mobile device. A wired networking solution is more reliable than Wi-Fi and has greater security.

Tablets supporting Wired Ethernet operation provide options for dynamic address setup (DHCP) and static address setup. The choice of address management is a Network system issue. The Ethernet addressing configuration is performed within the mobile device setup menu.

The mobile device setup and Ethernet port status are located in the Connections > More networks > Ethernet menu. The Ethernet menu can only be entered when a powered Ethernet adapter is present. The standard mobile device options permit the use of static address assignments or dynamic address assignments via DHCP. The menu reports if the Ethernet adapter is active as well as serving as the adapter enable.

When using DHCP, the mobile device attempts to fetch the network addressing information from a DHCP server. If the addressing information is not located within the timeout period, the mobile device makes no further attempts. The user must manually retrigger the Ethernet interface to start the DHCP process. The retrigger is a simple matter of pressing the Ethernet "box" again in the "More networks > Ethernet" menu.

Power Options

Most nSynC products can be powered using a standard USB Power supply, such as the one provided with the tablet or mobile phone. The typical power supply provided with a Samsung device is rated at 5 volts nominal output voltage with a 2-ampere capacity.

Any 5-volt regulated power supply is permitted, provided at least 5 volts is present at the input to the nSynC. The preferred voltage is 5.1 to 5.25 volts. The input voltage must never exceed 5.25 volts. Exceeding the maximum input voltage violates LAVA's Manufacturer Warranty.

The nSynC-PE and nSynC-P2UE support Power over Ethernet (PoE) and therefore can operate using power provided over the network cable. Using PoE can resolve the problem of getting power to a device when an AC outlet is not accessible.

Using a PoE injector is a method of supplying power to an nSynC-PE or nSynC-P2UE-based system, even when wired Ethernet is not required by the customer application.

The nSynC "vc" products are designed to operate from a 9 to 36 VDC unregulated power supply. This power option is ideal in vehicle-based applications or any stand-alone unit running from a storage battery. In a retail or business environment, this option permits the power brick to be placed up to 50 feet away from the nSynC when a wall outlet is not in a convenient location.

Please see the "Connection Descriptions" section of this document for additional details on each of the power options summarized here.

Status LED lights

Status LEDs

Each nSynC has two primary Status LEDs. The mounting location varies between each nSynC product. The nSynC products in a casing always have the two primary Status LEDs mounted one above the other as shown in the following diagram.

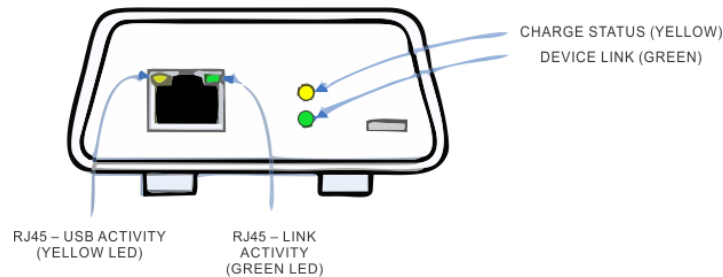


Figure 1: Typical nSynC Case

Units with Ethernet support also have two status LEDs mounted in the RJ45 receptacle, which are described in the Ethernet RJ45 section. USB Hub units without Ethernet support have a “USB connect” LED which indicates if a peripheral is connected to the adapter.

The "Charge Status" and "Device Link" LEDs are pulsed as a start-up test. The LEDs are pulsed once for an Mk1 device, and 4 times for an Mk2 device.

The chart below explains the various states for the "Charge Status" and "Device Link" LEDs, once the start-up test of the LEDs has completed:

STATUS LED STATES (for “extended” Mode enabled)			
Name	Colour	State	Description
DEVICE LINK	Green	Rapid blink	See the Charge Status LED description for “rapid blink”.
		1-second blink	See the Charge Status LED description for “1-second blink”.
		On solid	A mobile device has been attached and detected.
		OFF	No mobile device attached.
CHARGE STATUS	Yellow	Rapid blink	The LAVA unit is in the bootloader. When the J15 jumper is installed, the unit remains in the bootloader after power up. All “extended” features are suspended while the bootloader is active.
		1-second blink on both LEDs, and both LEDs are synchronized	The LAVA product is waiting for a mobile device to be attached.
		OFF	The LAVA product has no power.

STATUS LED STATES (for “extended” Mode disabled)			
Name	Colour	State	Description
DEVICE LINK	Green	On solid	A mobile device has been attached and detected.
		OFF	No mobile device attached.
CHARGE STATUS	Yellow	1-second blink	Power has been applied to the LAVA product.
		Off	The LAVA product has no power.

Note: The 2-pin internal jumper is shorted to disable the “extended” features of the nSynC to function. In this state the unit operates with only the “standard” features of the core nSynC products.

Mobile Device Charging with USB Host Operation (SimulCharge)

Overview

Mobile devices were intended to be standalone devices. When the mobile device battery requires charging, it is plugged into a Wall/USB Charger to restore the battery charge. The mobile device can continue being used while it is charging. Once the battery is charged, the mobile device may use the charger as a supplementary power source if the mobile device is left running. It is preferable to charge a mobile device with the unit off and remove the supply once a full charge has been reached for the longest battery life.

When using a Wall/USB Charger provided by the mobile device's manufacturer, it can often charge at a high rate that is mobile device specific. The charge rate is also limited to the power available from the attached charger. Samsung Wall/USB Chargers, for example, come in several power ratings, each matched to the original mobile device requirements.

Charge-Only Mode

A fast charger, such as a Samsung Wall/USB Charger, is equivalent to a USB Charger with a Dedicated Charge Port (DCP) as defined by the USB Battery Charging Specification R1.2.

LAVA products use the term Charge-Only Mode to indicate the battery is being charged at the highest rate permitted by the mobile device and is equivalent to a USB Charger with a Dedicated Charge Port (DCP).

USB Host versus Accessory

A mobile device plugged into a desktop (or laptop) PC is treated as a USB Accessory (also referred to as a USB Target). The PC operates as a USB Host Controller when the mobile device is attached. The PC provides power to the mobile device, but the mobile device battery is being charged at a low rate. In some cases, the battery may not charge.

To plug a USB Accessory into a mobile device, the mobile device must operate as a USB Host Controller rather than a USB Accessory. The USB Standard has the On-The-Go (OTG) feature, in which the mobile device detects that a USB Accessory has been plugged in and automatically switches to operate as a USB Host Controller. Not all mobile devices support the USB OTG feature. When operating as an OTG USB Host, the mobile device is expected to supply power to the attached accessories, which means power is drained from the mobile device battery.

SimulCharge Mode

The nSynC products place a compatible mobile device into the SimulCharge Mode. SimulCharge Mode informs the mobile device to operate as a USB Host controller, but not to provide power for USB accessories. With SimulCharge mode active, the mobile device is expecting power to be provided to it for battery charging and running the mobile device. This allows the mobile device to be run while simultaneously interacting with one or more USB accessories. The SimulCharge charging rates are specific to each mobile device.

Mobile devices operating in SimulCharge mode may limit the amount of power drawn from the external power source. Limiting the power drawn from the external supply allows the supply to be shared between the mobile device and USB accessories. If there is not enough power coming in, the mobile device takes the extra from the battery. In this case, the battery will not be charging. The screen brightness may have to operate at less than 100% to allow the battery to charge. The colour scheme of the device application can be designed to reduce the power required. Application processes requesting too much CPU time increase the power needed for the mobile device.

The nSynC products use features specific to a set of compatible mobile devices which are identified in the System Requirements section. Simultaneous battery charging and USB Host operation are not universal among mobile devices. Mobile device models have different features based on country/region.

The nSynC products must always be powered to keep the mobile device charged, and allow operation with USB accessories.

Connection Descriptions

USB-C “Mobile Device” Data & Power Output

The “Mobile Device” receptacle is a standard USB-C receptacle, which is used for the connection between the nSynC and a tablet or mobile phone. This connection provides a power and data connection to the device.

When the nSynC is not powered, the device is not expected to provide power to the nSynC. This behavior is deliberate to avoid the device accidentally being drained of power by the nSynC and attached peripherals.

The cable should not exceed the 2 meter (6.6 foot) limit defined by the specifications. The cable need not be electronically marked due to the current levels involved.

The USB-C cable must support **both data and charging**.

It does not matter which end of the cable is attached to the device or the nSynC product.

USB-C “Power Adapter” Input

The “Power Adapter” input is a USB-C receptacle on nSynC products without Power over Ethernet or a built-in voltage converter. This input provides power for the nSynC product, the device, and for attached USB accessories.

The nSynC product does not function if power has not been applied to the Power Adapter input. The nSynC products are not intended to draw power from the mobile device.

A standard USB 5V DC Power Supply is attached to the Power Adapter input. A standard USB power supply is rated at 5 volts nominal, with a 5.25 volts maximum. The typical current rating is 2 amperes for a device with at least a 10-inch screen. A typical USB Power supply is rated at 10 watts (2 amperes at 5 volts DC).

The USB Power Supply provided with most Samsung devices is rated at 5.3 volts and 2 amperes. When using the charge cable provided by Samsung, the voltage delivered to the end of the cable will typically be from 5.0 to 5.1 volts. Some power supplies compensation for wire losses.

The voltage at this input should not be much below 5 volts. The preferred level is 5.1 to 5.25 volts.

The Adaptive Fast Charger being shipped with many Samsung devices is fully compatible. These adapters are rated at 5 volts 2 amperes and 9 volts 1.6 amperes. The nSynC products automatically use the 5-volt option.

The Power Adapter input on the nSynC products can be used with an external USB Power Bank (aka. USB Battery Pack). This ability can be useful in some deployments. The USB Power Bank must be physically removed for recharging.

The cable length between the power supply and the nSynC product must be as short as possible. The cable experiences power loss proportional to the cable length and wire thickness. The voltage present at the nSynC receptacle will be lower than the supply output due to cable power loss. There is power loss in the cable which connects the nSynC to the device. If the voltage at the device is too low, the device will not charge.

The USB specification defines the minimum voltage of 4.75 volts for USB accessories operating at a full unit load. When connecting some accessories to the device via an nSynC product, the cable quality and length must be selected to ensure that the voltage reaching each accessory is at least 4.75 volts as a general rule. Many devices such as mice operate at a lower voltage than 4.75. A power budget must be carefully evaluated for the system if reliable operation is to be ensured.

The models with the Power Adapter input include the nSynC-1U, nSynC-1U-OEM, nSynC-3U, nSynC- E, and nSynC-2UE.

“Aux. Power Adapter” input

The “Aux. Power Adapter” input is a Micro-B USB receptacle on nSynC PoE products and a USB-C receptacle on certain products with voltage converters.

This input is used for system testing when PoE power **is not** present. The nSynC product will be fully functional, including the 10/100 Ethernet, when this power input is used.

This receptacle **is only** for providing power to the nSynC product.

This power input has the same specifications as the “Power Adapter” Input.

The PoE models include the nSynC-PE and nSynC-P2UE products. The adapters with built-in voltage converters that offer an “Aux. Power Adapter” include the nSynC-vc3U and the nSynC-vc1U.

Warning: *When supplying power using the “Aux. 5 Volt” input, you must not use PoE-supplied power or the “9-36 VDC In” receptacle.*

Barrel Jack “9-36 VDC In”

LAVA products equipped with the “vc” option include a power option that uses a DC barrel jack with a 2millimeter positive center pin. The power cable and power supply are supplied by the user.

Many use cases require up to a 24-watt power supply (12 volts at 2 amperes or 24 volts at 1 ampere). The permitted input range is 9 to 36 volts. Any unregulated power supply can be used. This range of supported voltages permits the power supply to be placed up to 50 feet (15 m) away from the LAVA product when a suitable wire gauge is used.

The minimum power specification for a use case requires developing a power budget that is based on the USB peripherals you wish to use and the mobile device. In cases where no external USB peripherals or a few low-power peripherals are used, the power supply requirements can drop down to 12 watts (12 volts at 1 ampere, or 24 volts at 0.5 amperes). The internal power converter within the LAVA product is 80% efficient at full load, therefore 12 watts into the product results in 10 watts for system use.

A power supply with a higher power rating than the required minimum is always permitted. This has the benefit of your hardware system running cooler. As an example, if your system ideally requires a 12-volt, 2-ampere power supply, then a 12-volt, 2.5-ampere supply is acceptable.

The length and gauge of wire used to connect the power supply to the LAVA product results in a loss of voltage and therefore power reaching the LAVA product. This additional loss must be factored into the power budget as well. A higher power supply voltage is always preferred to minimize the power loss in the wire.

When connecting the LAVA product to the supply, ensure the wiring is such that the center pin is positive. If the polarity is reversed, the damage to the LAVA product is immediate. Application of the wrong input voltage violates LAVA's Manufacturer Warranty.

The attached power supply and wiring are responsible for providing short circuit protection.

USB-A Receptacles

Several LAVA products support one or more USB 2.0 ports with a standard A-type receptacle. Each receptacle allows a USB Accessory to be accessed by the mobile device.

Each receptacle provides power to each USB accessory up to a maximum of 500 mA, as per the USB specification. The product power supply must have sufficient capacity to supply power for the mobile device, the LAVA product, and the attached USB accessories combined.

The USB ports can be extended using a compatible USB 2.0 hub. If the external hub is not self-powered, then the LAVA product's power supply must have sufficient capacity for the hub, the mobile device, the LAVA product, and the attached USB accessories combined. The external hub and accessories are not permitted to draw more than 500 mA from a USB-A port.

RJ45 “PoE Ethernet Port”

The PoE Ethernet Port has all the features of the Ethernet Port described in the next section and resolves the problem of getting power to a mobile device and peripherals.

This port is attached to a Network Switch, which has been configured for PoE operation.

Use of a PoE Injector allows a non-PoE switch to be used with a PoE-enabled product. A PoE Power Injector is a standard add-on available from many Network Switch vendors.

The PoE (Power-over-Ethernet) specification allows the unit that is being powered to be located up to 328 feet (100 meters) away from the Network Switch or PoE Injector.

Deploying network cabling with PoE support can be significantly cheaper than installing dedicated power lines through a facility. Using PoE to supply power to a unit can be advantageous even when no Ethernet data is required.

The LAVA PoE products provide up to 10.4 watts of power for the device and attached peripherals. The 10.4-watt limit allows the unit to be treated as a PoE Class 0 device by a PoE switch.

The LAVA product is capable of supplying 13.5 watts to the device and peripherals. However, this requires the Network Switch to provide more power to the Ethernet cable than is permitted for Class 0 devices. The LAVA product does not prevent the attached devices from attempting to draw more than 10.4 watts. The accompanying device and USB accessories must be designed to work within the design limits.

The system designer must budget for the charging requirements of the mobile device and the power required by USB accessories. The LAVA products do not provide diode protection between the module and the peripheral ports.

The LAVA PoE products do not function if power is not available from the PoE-Ethernet interface or the Auxiliary Power input. The LAVA products are not intended to draw power from the mobile device. The Auxiliary Power input is only be used if power is not being provided over the Ethernet cable. The Auxiliary Power input is intended for the initial testing of a LAVA product. The Auxiliary Power input is described in a separate section of this document.

Warning: *When supplying power using the "Aux 5V Input", you must not use PoE-supplied power.*

RJ45 “Ethernet Port”

The Ethernet Port is an IEEE 802.3 10BASE-T / 100BASE-TX compatible Fast Ethernet interface. The Ethernet port accepts a standard RJ45 connector. The Ethernet port is present on a number of LAVA products.

The Ethernet port only functions when the LAVA product is powered. The LAVA products have a dedicated power input and are not intended to draw power from the mobile device.

The Ethernet port has two status indicator LED lights labeled "USB Activity" and "Link/Activity".

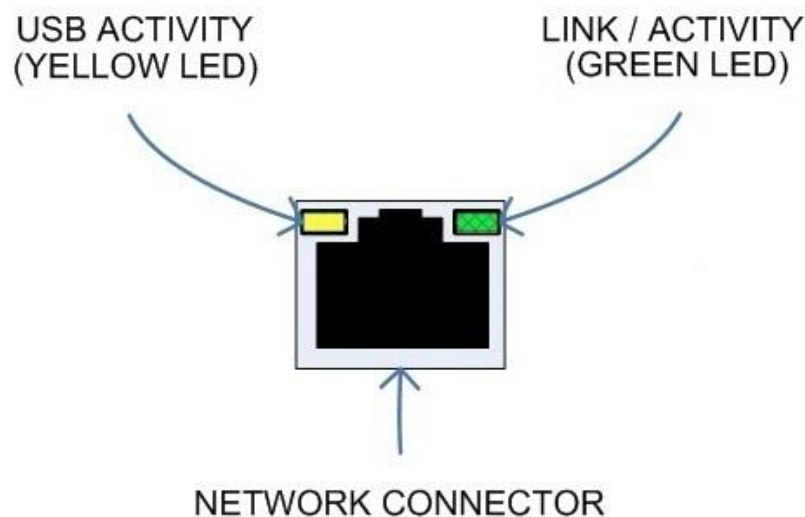


Figure 2: RJ45 Status Indicators

The USB Activity indicator is a yellow LED light. The USB Activity LED is solid yellow when the LAVA product is powered and connected to the mobile device. The USB Activity LED flashes when there is traffic between the mobile device and a LAVA product.

The Link/Activity indicator is a green LED light. The Link/Activity LED is solid green when the Ethernet Link has been established. The Link/Activity LED flashes when there is network traffic through the Ethernet interface. The Link/Activity LED remains off when the mobile device is not attached.

The Ethernet peripheral integrated within a LAVA product is subject to support built into the mobile device. Any details related to Ethernet setup and Network configuration are described in the documentation provided by the manufacturer of the mobile device.

Technical Support

LAVA Technical support is open from 9:00 am to 5:00 pm Monday through Friday (ET).

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