NONLINEARLABS

User Manual

C15 MIDI Bridge

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C15 MIDI Bridge
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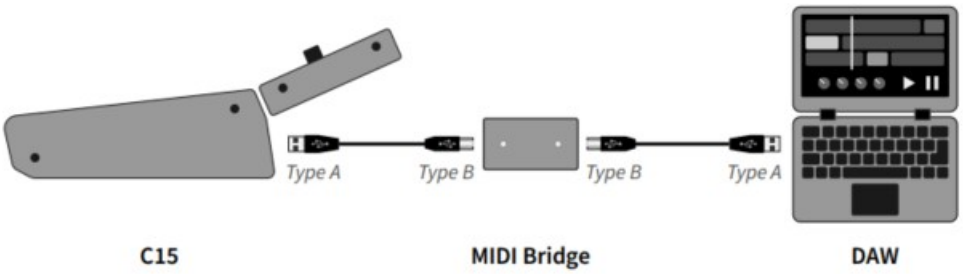
Content

1. General

1.1 Usage and Operation

Usage:

The MIDI Bridge is intended to connect two MIDI systems together when both systems are USB Hosts. A typical example is a Digital Audio Workstation (DAW) running on a PC and a NonlinearLabs C15 Synthesizer.



As the C15 only offers a USB host-type socket (USB Type A) it cannot be connected to the PC directly, therefore a data bridge is needed which has USB device-type sockets on both ends (USB Type B) so that the device can be connected to both hosts.

The applications on both hosts then can communicate with each other in any direction through a USB MIDI Device which appears as “NLL-MIDI-Bridge”. The bridge does not change or interpret the data in any way and is fully transparent.

Operation:

The device waits for a MIDI data packet to be received on *one port* and when this happens, the packet is send out on the *other* port.

This happens for both directions independently and simultaneously.

The transfer process can be monitored with the two LED indicator lights on the top, one for each port, showing incoming data and its delivery status.

The bottom plate of the MIDI Bridge is internally equipped with magnets so that you can attach the device to magnetically responsive surfaces, notably the steel chassis of a NonlinearLabs C15 Synthesizer.

> WARNING: Those magnets have considerable strengths so keep the Bridge away (> 0.5m) from mechanical watches, cathode ray displays/monitors, credit cards etc with magnet strips, audio or video magnetic tapes and recorders/players, and especially from body-implanted medical devices like pacemakers.

1.2 Packet Latency

The typical transfer time for the usual short MIDI packet is about 100µs (µs is “micro-seconds”; one-millionth of a second) of in either direction, assuming very little other traffic loads on the two USB busses.

When a packet could be sent within less than 300µs, the transfer is considered REALTIME.

When a packet could be sent within 300µs and 2ms, the transfer is considered LATE.

When a packet could be sent only after more than 2ms, the transfer is considered STALE.

All these considerations are for information, they do not represent error conditions.

1.3 Dropped Packet Errors

When a packet cannot be sent out in due time, the transfer is considered DROPPED and will be aborted. This is an error condition and may happen either when the outgoing port is not connected/ready or the host computer is currently not reading data within due time, stalling the transfer (Note: Windows will always accept MIDI data over USB and will never stall whereas on Linux and MacOs a running application that *actually reads* MIDI data is required to avoid the stalling condition).

When the outgoing port is not ready (not connected or not detected by the USB-host) the packet is dropped immediately.

When the port is ready and a first stalling condition occurs, a timeout of *100ms* is used and the packet is dropped. For subsequent stalling packets, the timeout is reduced to *5ms*. It then takes one successful packet delivery to reset the timeout to *100ms* again.

Technical detail: Until a transfer has finished (or was aborted), receiving of further packets is blocked temporarily. There is no internal buffering, rather the transfers are in real-time, one at a time.

2. Indicators

Each port side has a RGB (true color) LED indicator which shows both the *port status* and the *packet status* while a packet is running through. Each port LED is referring to the *incoming* data on that port.

The LED color basically indicates the port status, which is the largest latency range measured in recent packet delivery (ranging some seconds back).

The LED is temporarily flashing brighter when an actual packet is running through the device and the color indicates the current latency.

2.1 Continuous Port Status Display (dim colors)

The dim color of the LED represents the current status of the port :

Pulsing blue (slowly blinking, 3s period)	port is not connected.
Pulsing cyan (slowly blinking, 3s period)	port is connected and receives USB power, but no USB communication is present.
Green	port is connected and USB communication is ready to go.
Yellow	port is connected and USB communication is ready to go, but there were LATE packets within the last *two* seconds.
Red	port is connected and USB communication is ready to go, but there were STALE packets within the last *four* seconds.
Magenta	port is connected and USB communication is ready to go, but there were DROPPED packets (with data loss) within the last *six* seconds.

2.2 Flashing Packet Status Display (bright colors)

On top of the steady-state port status display above, the MIDI Bridge independently indicates the status of the current packet while it runs through the device. This again is color-coded but can be distinguished from the port status in that the LEDs go full brightness.

Green ●	packet is running for less than *300µs* (REALTIME).
Yellow ●	packet is running for less than *2ms* (LATE).
Red ●	packet is running for more than *2ms* (STALE).
Magenta ●	packet had to be dropped (data loss).

NOTE: Because the actual transfer times are normally very short (< 100µs) they are lengthened for display. Still the short true transfer time is directly indicated with even brighter colors, and notably the normal green color gets brighter and more cyan'ish when very dense traffic is present. In normal MIDI operation the traffic is very sparse, though.

NOTE: As long as you see any LED indicator activity (steady-state on or blinking) the device is powered up and consumes electrical current. Therefore, to save power, you may want to unplug the device from computers while those are in standby, hybernate or power-down modes but still apply supply voltage to their USB sockets.

3. Special Error Color/Blink Codes

In normal operation, including a firmware update via MIDI SysEx message, ***none*** *of the below errors will ever occur* (except for “Programming Finished”)... but things might go wrong on very very seldom occasions.

These are unrecoverable but mostly non-persistent errors in general, the device is temporarily not operational after an incident. The device must be fully unplugged to reset and return to normal operation.

The LED indicator patterns are meant for post-mortem diagnosis, so please write down the colors and blink states should you ever run into such an error. The blink rate is very fast.

First LED	Second LED	Meaning
GREEN blinking	GREEN blinking	Programming Finished Successfully (NO ERROR)
WHITE	WHITE (blinking or not)	Severe Code Error (Lock-Up) *)
RED	RED blinking	USB Packet incorrect size
RED	YELLOW blinking	Unexpected USB Packet
YELLOW	RED blinking	SysEx Data Error
YELLOW	YELLOW	Waiting for SysEx End Marker
MAGENTA	RED blinking	Programming: Data is too large
MAGENTA	GREEN blinking	Programming: Data Length is zero
MAGENTA	BLUE blinking	Programming: Erase failed **)
MAGENTA	MAGENTA blinking	Programming: WritePrepare failed **)
MAGENTA	WHITE blinking	Programming: Write failed **)

*) Software Bugs as well as Broken Code -- for example from an update gone wrong -- will often, but not always, end up with the WHITE-WHITE “code error” pattern.

**) Should one of these severe failures ever happen during a firmware update, it is very likely that the device is now “bricked”, containing a partial or broken code update and thus rendered inoperable and refusing to take further updates. It then should be returned to factory for servicing.

4. Firmware Version Identification (Blink Pattern after Power Up)

To identify the current firmware version in the device, a specific blink pattern is displayed after power has been applied via one of the USB ports:

The first LED blinking YELLOW for N times, like, say, two times:
Major Revision Number is N = 2

Then, second LED blinking CYAN for K times, say, three times:
Minor Revision Number is K = 3

Effective firmware Version is N.K, with K displayed with two digits. For the example:
Version = 2.03

There might be additional blink patterns following after the firmware version, like both LEDs blinking RED three times which indicates the used firmware is a special beta/test version.

5. Firmware Update

> **Important note:** The MIDI Bridge only accepts a firmware update when *no* MIDI traffic has occurred since power-up, otherwise it will simply try to deliver the MIDI data on the other port as in normal operation.

1. Fully disconnect the MIDI Bridge.
2. Connect MIDI Bridge to PC only (which port used on the MIDI Bridge does not matter).

3a. For Linux Users, using `amidi` (https://www.systutorials.com/docs/linux/man/1-amidi/)

- find hardware port ID with `amidi -l`, say it was `hw:1,0,0` for example
- send SysEx with `amidi -p hw:1,0,0 -s nlmb-fw-update-VX.YZ.syx`
  (X.YZ must be replaced with the actual firmware number)

3b. For Windows/Mac users:

- use an application like "MIDI Tools" (https://mountainutilities.eu/miditools)
- load the Firmware SysEx file
- send it to MIDI Bridge

If the firmware update was successful, the MIDI Bridge will show that by both LEDs blinking fast in bright GREEN color ● ● ● ● ● and then will reset itself after 5 seconds, afterwards showing the new Firmware Version during startup.

If the update failed, try again the full cycle from step 1 (note: try using also the other port of the MIDI bridge).

4. Optional Firmware Version Check (besides the visual Firmware Version Display):

   • Software like "MIDI Tools" must be restarted and then will show the new firmware version of a connected Bridge in the setup screen.

   • on Linux, use the command `usb-devices | grep -C 6 -i nonlinear`

> Windows hint: To remove stale entries potentially causing wrong display of the device name, go to device manager, select "show hidden devices", then delete all "NLL-Bridge" entries. Do this while the MIDI Bridge is *not* plugged in, of course.

6. Hardware Port Speed Identification

Technically, both ports of the Bridge are USB2.0 compatible but only one port offers the maximum speed of 480Mpbs (“High-Speed”), the other runs at 12Mbps (“Full-Speed”). Both speeds are way beyond the data rates that will normally ever be used or needed by MIDI, though. Only when an USB bus is almost saturated by other than MIDI traffic there could be cases where one wants to connect the High-Speed port of the Bridge to a specific bus.

The High-Speed port side of the Bridge can by identified during the LED pattern display of Firmware Version, it is located at the side where the first blink pulse is seen, in yellow (see section “Firmware Version Identification”).