

***RR-CirKits***

Specializing in Affordable Electronics for Model Railroads

# LocoBuffer-II Rev-f

RS232 Serial to LocoNet® Interface

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## User's Guide

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LocoNet® is a trademark of [Digitrax Inc.](http://www.digitrax.com/) (<http://www.digitrax.com/>)

## **6.2 Loop Back Test**

The LocoBuffer-II input circuit and code actually reads from the LocoNet® output jack, so if you enable the LocoNet® terminator and set SW5-6 to ON (down) so that the LocoNet® circuitry gets it's power from the power adapter, then you have created a loop back test. The only thing that is not tested is the LocoNet® jack itself. This test uses the free software available from the JMRI project to watch the test commands. ([www.jmri.info](http://www.jmri.info))

Steps:

1. Unplug the LocoNet® cable
2. Set Sw2, Sw 5-6 ON, all other switches OFF
3. Set the JMRI LocoBuffer options to 19,200 baud and hardware handshaking enabled
4. Open the JMRI LocoNet® Monitor window.
5. Using JMRI send some commands (e.g. switch commands)
6. The commands should appear in the LocoNet® monitor window and the LocoBuffer-II activity LED should blink
7. Disable the terminator (unless your application requires it) Sw2 OFF
8. Restore the LocoBuffer-II option switches to their normal settings for your application

## **7.0 Warranty Information**

We offer a one year guarantee on the LocoBuffer-II only. This device has no user serviceable parts. If a defect occurs, contact RR-CirKits at [service@rr-cirkits.com](mailto:service@rr-cirkits.com) for a RMA.

## **8.0 FCC Information**

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.

Note: 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.

Any modifications to this device voids the user's authority to operate under and be in compliance with these regulations. The actual measured radiation from the LocoBuffer-II is much lower than the maximum that is permitted by the FCC Rules, so it is unlikely that this device will cause any RFI problems.

**Switches 5 and 6** control the internal power connections. The LocoBuffer-II is an optically isolated device. Set **switches 5-6 off for isolated mode**. There is normally no internal connection between the computer side and LocoNet® side of the device. The LocoNet® circuits are powered from the Rail\_Sync lines. (pins 1 and 6 of the LocoNet®) The RS-232 circuits and processor chips are normally powered from an isolated external power supply. In some cases it may be desirable to use alternate power options. If you switch both Switch 5 and 6 to their “Local Power” (*on*) positions, the internal power circuits are then connected together. If you have sufficient Rail\_Sync power (at least 30ma. at 8V) then you may power the entire LocoBuffer-II from the Rail\_Sync power of the LocoNet®. This may be especially useful for Laptop users. Note, because the internal circuits are connected together in “Local Power” mode the opto isolation is rendered ineffective.

## 4.0 Optical Isolation

The LocoBuffer-II offers complete electrical isolation between the computer and the LocoNet®. This prevents possible ground loop problems between the LocoNet® and computer. For example, many systems are installed without properly grounding the booster to power ground. Some devices connect the LocoNet® ground directly to the serial cable ground. This provides a ground path from the power line through your computer and it's serial cable to the LocoNet® and then to the booster and all the railroad wiring. At best this indirect grounding causes electrical noise. At worst it could create a fault path via the small gage LocoNet® wiring to ground. If a desktop computer and your booster are not properly grounded this could put up to half of power line voltage on your RR.

We recommend that both your boosters and your desktop computer be properly grounded through a 3 wire cable, and that the two be isolated from each other via the LocoBuffer-II.

## 5.0 LocoNet Terminator

This device includes a built in 15 ma. terminator for the LocoNet® bus. This can be used to provide the “Master” termination for a LocoNet® segment. If the LocoNet® Rail\_Sync power is at least 12V it will supply the required termination power. If not, then the LocoBuffer-II must be in Local Power mode and the power input should be at least 12V. Measure the voltage at the power jack of the power adapter.

To enable the terminator set switch 2 *on* (down).

## 6.0 Trouble shooting

### 6.1 Sanity Test

To perform a very basic LocoBuffer-II sanity test perform the following steps:

1. Unplug the LocoNet® cable. Disable the internal LocoNet terminator if enabled. (set SW-2 OFF)
2. Enable local power, if it is not already enabled. (Set Sw 5-6 ON)
3. Power up the LocoBuffer-II from a power adapter. Both green power LED's should come on.
4. Set SW-2 ON (down) then OFF (up). The red activity LED should blink briefly each time SW-2 is turned OFF.
5. Plug and unplug the LocoNet® cable. Again the activity light should blink.
6. Restore SW 2, 5, and 6 to their original positions as needed.

If the activity LED does not blink when you unplug the LocoNet® cable, be sure that your DCC command station is powered up, then check your LocoNet® wiring. To further test the LocoBuffer-II perform the following Loop Back test.

## 1.0 Features

- DB-9 serial RS-232 input
- 96 bytes of data buffering in each direction
- DIP switch settings for all options
- Optical isolation (except in LocoNet® powered mode)
- Boot Loader firmware upgrade
- MS-100, (16,457) 19,200, and 57,600 Baud speeds with hardware flow control
- External power adapter 9V-15V AC-DC
- Optionally powered from LocoNet® Rail\_Sync lines
- LocoNet® certified



## 2.0 Quick Start

- The default LocoBuffer-II options setting is 19,200 baud, all switches *off* (up). If your older software does not support the LocoBuffer-II, check with your vendor for an upgrade.
- Connect your serial cable to the computer and to the LocoBuffer-II.
- Connect the power adapter to the LocoBuffer-II and plug it in. The lower green status indicator should illuminate.
- Connect the LocoNet® cable to your system. The upper green status indicator should illuminate, and the red status indicator should indicate LocoNet® activity.
- Set your software port settings to match the communications port and baud rate that you have selected. (large or busy systems may prefer to use 57,600 baud)
- You should now be able to control your Railroad from your software.

## 3.0 Connections and Indicators

The LocoBuffer-II Rev-f has three connectors, three status indicators, and six option switches.

### 3.1 Serial Port Connector

The computer connection is made using a DB-9 M-F serial extension cable to connect from the LocoBuffer-II to your computer:

Pin	Direction	Signal	Description
1	Input to PC	DCD	Data Carrier Detect (held low)
2	Input to PC	RXD	Received Data
3	Output from PC	TXD	Transmitted Data
4	Output from PC	DTR	Data Terminal Ready
5			Signal Ground
6	Input to PC	DSR	Data Set Ready
7	Output from PC	RTS	Request To Send
8	Input to PC	CTS	Clear To Send
9	NC	RI	Ring Indicator (not used)

### 3.2 LocoNet® Connector

The LocoNet® connection is made to the LocoBuffer-II via a standard RJ-12 (6 pin) modular jack. LocoNet® cables are wired straight through, not reversed like phone cables.

Pin outs for the RJ-12 connector:

Pin	Description	Color
1	Rail_Sync-	white
2	Signal Ground	black
3	LocoNet-	red
4	LocoNet+	green
5	Signal Ground	yellow
6	Rail_Sync+	blue

Pins 2 and 5, and pins 3 and 4 are connected together internally.

### 3.3 Power Connector

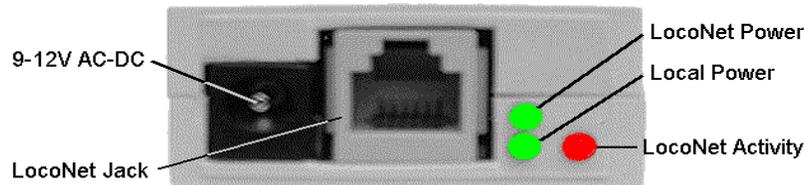
The LocoBuffer-II accepts either AC or DC power from a 9V to 12V external supply. The connector is a standard 2.1mm male coaxial jack that will accept most power adapter coaxial plugs. The external power connector normally powers the RS-232 interface and the internal processor portions of the circuit.

Option switches 5 and 6 (Local Power) are provided to allow power to be taken from the LocoNet Rail\_Sync lines. Note that the power required from Rail\_Sync is double the official limit of 15 ma. per device. You need to make sure that this does not cause a problem on your individual system. Also, using the "Local Power" option disables the optical isolation feature.

The LocoNet receiver and driver circuits normally receive power from the Rail\_Sync lines. If your LocoNet system Rail\_Sync lines do not have sufficient power to operate the LocoBuffer-II receiver and transmitter circuits, then you may switch to "Local Power" and supply power from an external power adapter. This disables the optical isolation feature.

### 3.4 Status Indicators

The LocoBuffer-II has three status indicators located next to the RJ-12 connector. The two green status indicators show the power status. The upper green indicator shows the power status of the LocoNet Rail\_Sync power input. The lower green indicator shows the power status of the external power source. The third red status indicator normally shows LocoNet activity. This indicator also blinks at the end of a boot load firmware upgrade when the boot loader process has completed.



### 3.5 Option Switch Settings

OFF	off 19,200 Baud	on 57,600 Baud	off Term Off	on Term On	LocoBuffer Mode	MS-100 Mode	off Normal	on Boot Program	Isolated Power	Local Power	Isolated Power	Local Power
▲												
▼												
ON	1	2	3	4	5	6						

The default switch setting is all switches *off*. (19,200, echo on, LocoBuffer mode, isolated)

*Note: Off is up - toward the serial number label.*

- Off* - 19,200 Baud in LocoBuffer mode. NA in MS-100 Mode.  
*On* - 57,600 Baud in LocoBuffer mode. NA in MS-100 Mode.
- Off* - Internal termination disabled  
*On* - Internal termination enabled
- Off* - LocoBuffer mode. (speed set by SW-1)  
*On* - MS-100 compatible mode. (speed set to 16,457 Baud)
- Off* - Normal  
*On* - Boot Program mode.
- Off* - Isolated power. Requires external power input.  
*On* - Local power. Powered from LocoNet®. (30 ma.) No isolation.
- Off* - Isolated power. Requires external power input.  
*On* - Local power. Powered from LocoNet®. (30 ma.) No isolation.

**Note: LocoBuffer-II must be powered down for switch setting changes to take effect.**

**Bold** indicates default setting.

**Switch 1** selects the baud rate in LocoBuffer mode. It has no effect in MS100 mode. **Sw1 off selects 19,200 baud.** Switch 1 on selects 57,600 baud.

**Switch 2** selects the internal termination mode: **off = disabled**, on = enabled.

**Switch 3** selects between LocoBuffer mode and MS100 mode. **Switch 3 off sets LocoBuffer mode.** The baud rate is set by Switch 1. Switch 3 on sets MS100 mode. The baud rate is set to 16,457 baud to match software that only supports the MS100.

**Switch 4** allows the LocoBuffer-II firmware to be upgraded via a simple serial download (boot mode). The control program PICdownloader.exe should work on all Windows platforms, 95-XP. You will only need to select the COM-port and baud rate (19,200) once. Note: the Ver: 2.000 firmware is only compatible with the LocoBuffer-II Rev-f PIC16F88 microprocessor. Do NOT load this firmware into an earlier version of the LocoBuffer-II.

To update your firmware remove LocoBuffer power, flip Switch 4 to on and then apply power. **Don't change any other switch, only Switch 4 is used!** The boot loader baud rate is fixed at 19,200 bps.

Select LB2000.hex or the latest LocoBuffer-II Rev-f upgrade file as the file to download. "EEPROM" should be unchecked. These settings are stored in a pic.INI file in the same directory as the PICdownloader.exe file, so the next time you use the program you will only need to hit Write(F4). Progress is shown in a bar graph and within 5 seconds you should have a working LocoBuffer-II Rev-f update. After programming, the flashing red LocoNet® activity led acts as a reminder to flip **Switch 4 back to off**. This will start the LocoBuffer-II immediately, with no extra power reset needed.