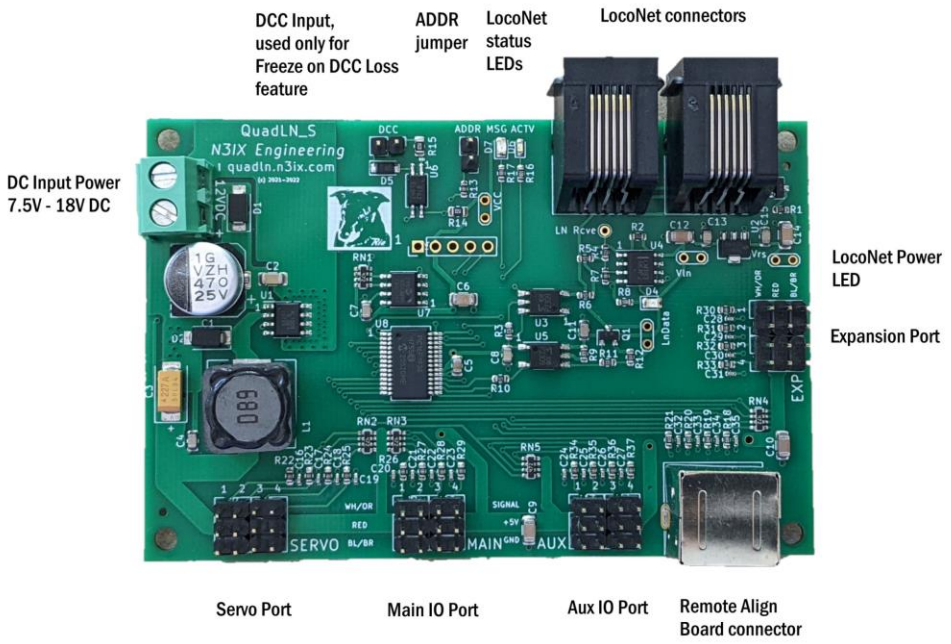
1 QuadLN_S Basics



1.1 Overview

The *QuadLN_S* is a stationary decoder that can control turnouts by driving servos (and stall motors using Driver add-on boards). The turnouts can be actuated using pushbutton or toggle switch inputs connected to **Main** IO or **Aux** IO ports. A single input can control one turnout or multiple turnouts.

The *QuadLN_S* can display the Turnout state on a Fascia Controller or drive user control panel LEDs. Besides showing whether a turnout is Closed or Thrown, the *QuadLN_S* can indicate when a servo is in motion (without requiring Turnout Position Feedback sensors!) and when a turnout is Locked.

The QuadLN_S can now control turnouts on all ports, meaning it can control up to **16** independent servos! This capability was added especially for users who employ software panels on tablets and smartphones to control their turnouts, and as a result do not require IO lines to connect pushbuttons or toggle switches. Table 1-1 below shows all the available port configuration combinations. Besides driving servos, optional inexpensive Driver add-on boards allow any mix of servo outputs and steady 5 volt outputs for stall motors or relays.

The *QuadLN_S* provides realistic signaling effects for Searchlight and Color Position Light signals and for Crossing signals using the optional Signal Board. Both Signal Head/Mast addressing and Turnout addressing for signals are available.

The *QuadLN_S* supports up to 4 current sense detectors using the optional Detector board.

The *QuadLN_S* is a LocoNet device. Turnout outputs (servos and stall motors) can be controlled via LocoNet Switch commands. Turnout position can be reported to software such as JMRI. The *QuadLN_S* even provides local control Lockout capability so that local control of turnouts can be disabled on an individual turnout basis whenever desired by just sending a LocoNet Switch command.

QuadLN_S inputs can be wired to external detectors and then report block occupancy using LocoNet General Sensor messages. Almost any device with a contact closure or 5V logic-level signal output can be wired to an available *QuadLN_S* input and then reported via LocoNet.

The *QuadLN_S* also includes Cascade and programmable Routes/ Selectors features that take advantage of the LocoNet to implement layout control functions such as yard ladder control and track selection.

Port Settings		Turnouts				IO			New in Ver 3.0
Expansion	**Main and Aux IO**	**Total**	**Main**	**Aux**	**Exp**	**Total**	**Detector Board**	**Signal Board**	
Relays	Both IO	4				8			
Signaling	Both IO	4				8		X	
Turnout	Both IO	8			5-8	8			
Relays	Both IO	4				4	X		
Signaling	Both IO	4				4	X	X	
Turnout	Both IO	8			5-8	4	X		
Relays	Main IO, Aux Turnout	8		5-8		4			X
Signaling	Main IO, Aux Turnout	8		5-8		4			X
Turnout	Main IO, Aux Turnout	12		5-8	9-12	4			X
Relays	Main IO, Aux Turnout	8		5-8		0	X		X
Signaling	Main IO, Aux Turnout	8		5-8		0	X	X	X
Turnout	Main IO, Aux Turnout	12		5-8	9-12	0	X		X
Relays	Both Turnout	12	5-8	9-12		0			X
Signaling	Both Turnout	12	5-8	9-12		0		X	X
Turnout	Both Turnout	16	5-8	9-12	13-16	0			X

Table 1-1 Available Port Combinations with Firmware Version 3

1.2 Turnouts - Servos and Stall Motors

The *QuadLN_S* can drive up to 16 SG-90 servos for controlling turnouts or performing other layout animation tasks. Independent control over the travel and speed for each servo make turnout movement realistic. With the addition of inexpensive Driver Add-on Boards, the QuadLN_S can control a mixture of servos and 5 volt devices such as stall motors or low current relays.

1.3 External Power Supply

The *QuadLN_S* requires an external DC power supply between +7.5V and +18V. Do not exceed +18V DC. Typical current is 100-500 mA from a 12V supply, but heavy servos mechanical loads can increase the current beyond that range. It is strongly recommended that you do not share the *QuadLN_S* power supply with any devices that have non-isolated Loconet interfaces, as this would defeat the built-in isolation. See Section 2.1 for power connection details.

1.4 Onboard LED Indicators

There are 3 LEDs on the *QuadLN_S*.

LN Power LED

The LN POWER LED indicates that LocoNet Rail Sync is present and the opto-isolated LocoNet interface is powered. This LED should be ON when a LocoNet cable is plugged into the *QuadLN_S*.

MSG LED

The MSG LED is normally lit. The LED blinks once when any LocoNet message traffic is seen, other than messages sent by the *QuadLN_S*. If this LED never blinks then there is probably a LocoNet connection issue.

ACTV LED

The ACTV LED is normally lit. The LED blinks once when any LocoNet message is sent by the *QuadLN_S* or when the *QuadLN_S* acts upon any incoming LocoNet message.

1.5 Frog Power

The *QuadLN_S* can drive 5 volt remote relay boards for powering turnout frogs and other uses. The relay state changes at the turnout travel midpoint to reduce problems with electrical shorts during turnout movement.

1.6 Inputs

The *QuadLN_S* MAIN and AUX Ports can each provide 4 signal Inputs. All inputs are fully configurable, including what action to take and what type of input change should trigger the action. Possible actions on an input change include controlling the onboard turnouts, sending Switch commands to other decoders or to trigger routes, and generating general sensor messages that report the input change to any interested LocoNet device.

The *QuadLN_S* has special features that allow the MAIN and AUX input lines to also drive LED indicators or other devices. Since each "input" also has an "output" capability, each connection is called an "IO" line in this manual (IO = Input / Output).

The *QuadLN_S* has an optically isolated DCC input that can optionally monitor the presence or absence of DCC on a power district. This input can be used for freezing input values when there is no DCC signal or for track power status reporting.

1.7 Addresses

Device Address

The *QuadLN_S* requires a Device Address so its features can be configured via LocoNet **Ops Mode** programming. This address is just for device programming and is independent from the Turnout and Sensor addresses which are described below. The valid range for the Device Address is 0-16383 and it must be unique.

Typically a 5 digit extended address is used for the Device Address. This avoids conflict with locomotives and other devices when doing **Ops Mode** programming. The default Device Address is 11000. When first installing *QuadLN_S*'s remember to connect just one unprogrammed unit at a time to LocoNet and change the Device Address to a unique address following the procedure below.

SERVO, MAIN, AUX and EXP Turnout Start Addresses

The *QuadLN_S* Turnout Outputs for each Port respond to LocoNet Switch commands at 4 consecutive addresses starting at the Turnout Start Address for that Port. The Turnout Start Address can be from 1 to 2045. Avoid using addresses 1017-1020 for any Turnout (those addresses are used by the LocoNet special interrogation commands). The Turnout Address ranges must not overlap.

SERVO, MAIN, AUX and EXP Lock Start Address

The *QuadLN_S* Locks for each Port respond to LocoNet Switch commands at 4 consecutive addresses starting at the Lock Start Address for that Port, or to a single address for an entire port if the "One Lock Per Port" feature is enabled (see **Error! Reference source not found.**). The Lock Start Address can be from 1 to 2045. Avoid using addresses 1017-1020 for any Lock (those addresses are used by the LocoNet special interrogation command). Lock Addresses should be unique. If any Turnout and Lock address ranges overlap, any Lock with the same address as a Turnout will not be accessible using LocoNet Switch commands.

Main IO Start Address

The *QuadLN_S* reports the status of its Main inputs using LocoNet Sensor addresses starting at the Main IO Start Address. The *QuadLN_S* uses 4 consecutive sensor addresses for Main IO1 – Main IO4. The Main IO Start Address can be from 1 to 4093. In general the Main IO address range should not overlap the Aux IO address range.

Aux IO Start Address

The *QuadLN_S* reports the status of its Aux inputs using LocoNet Sensor addresses starting at the Aux IO Start Address. The *QuadLN_S* uses 4 consecutive sensor addresses for Aux IO1 – Aux IO4. The Aux IO Start Address can be from 1 to 4093. In general the Main IO address range should not overlap the Aux IO address range.

1.8 Groups

The *QuadLN_S* has 1 functional Group for each Turnout output. Each Group consists of a Turnout and optionally a Main IO line and/or Aux IO line based on the Port configuration. As shipped, the IO lines in each Group are configured for a momentary pushbutton and change the state of the Turnout on each button press.

Any IO Input can be configured to control any Turnout output. In fact any input can control as many of the *QuadLN_S* Turnout outputs as desired, or it can serve other functions and not control any *QuadLN_S* Turnout output. There are some *QuadLN_S* features (for example LED indication) that only work when an Input is used with the Turnout output in the same Group, so it is best to start with that arrangement when learning about the *QuadLN_S*.

Panel Indicators

The *QuadLN_S* can drive panel indicator LEDs connected to the Main IO and Aux IO lines. The panel indication shown on any specific IO line reflects the state of the Turnout output in the same group. Thus when using panel indicators such as the N3IX Engineering Fascia Controller, it is best to use an IO line in the same Group as the Turnout being controlled so that the position, movement and lock indications are meaningful.

2 Getting Started

2.1 Connecting Power

The *QuadLN_S* requires an external DC power supply between +7.5V and +18V. **Do not exceed +18V DC**. Typical current is 100-200 mA, but heavy servo mechanical loads can increase the current beyond that range. The power input is via the connector with two screw terminals near the upper left corner of the board. Connect the power supply **minus** lead to the **upper** terminal (the one closest to the corner of the board) and connect the power supply **plus** lead to the **lower** terminal (the one furthest from the corner of the board). If the leads are connected backwards, the *QuadLN_S* will not function but will not be damaged.

It is strongly recommended that you do not share the *QuadLN_S* power supply with any devices that have non-isolated Loconet interfaces, as this would defeat the built-in isolation.

2.2 Setup with JMRI

The *QuadLN_S* template in JMRI provides the easiest and quickest way to configure the overall device. This section covers the basics needed to get the decoder up and running. Later sections dive into the details.

2.2.1 Minimum JMRI Version

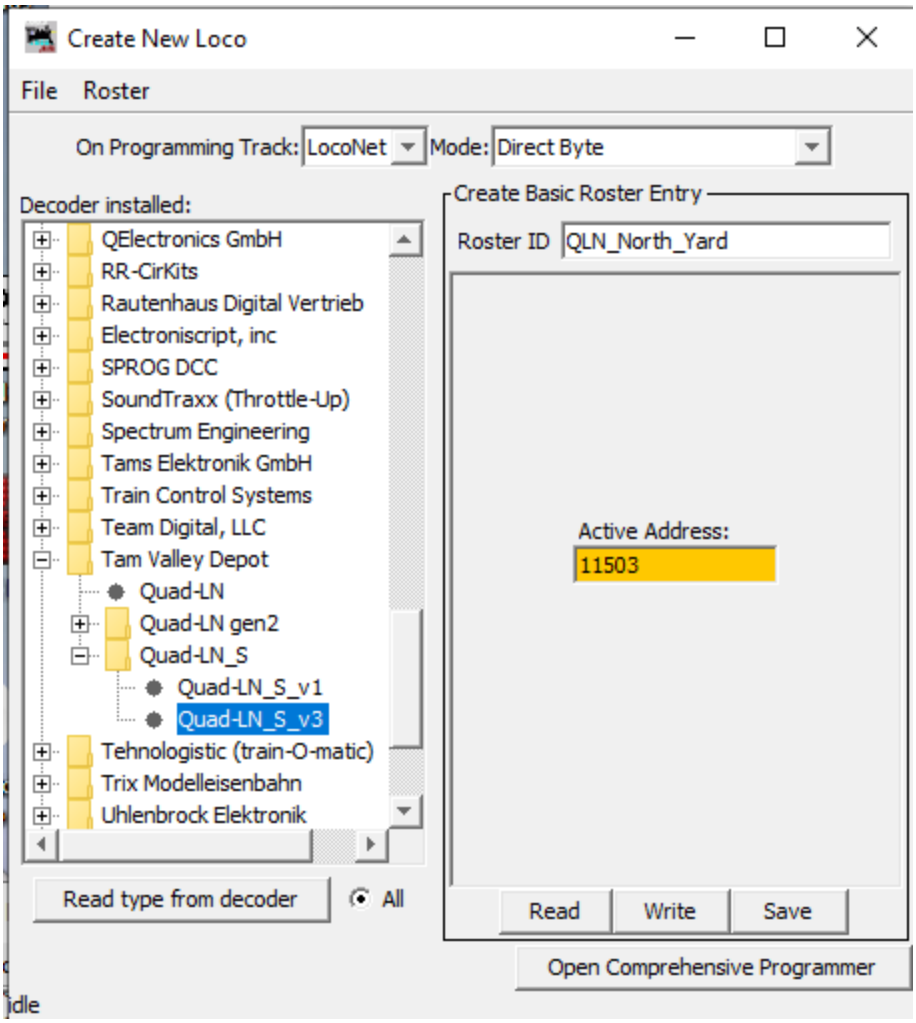
The latest released version of JMRI is recommended. The minimum version of JMRI is 5.2. JMRI version 5.8 and later have full support for *QuadLN_S* firmware version 3.3. To use JMRI version 5.2 to 5.7, install the available decoder template update (see the note in Section 2.2.3 below).

2.2.2 Create a roster entry and set the Device Address

Each decoder needs its own Roster entry so that there is a place to store the configuration settings that are unique to that decoder. In this step we will create the Roster entry for the decoder. We will also assign a unique Device Address to the decoder. When setting parameters of the *QuadLN_S* we will always use **Ops-Mode / Programming On Main**. The **Service-Mode/Programming-Track** Programmer is only required when performing a Factory Reset via JMRI.

The Device Address is set using programming messages that are received by the *QuadLN_S* over LocoNet. (The *QuadLN_S* is ***never*** connected to the programming track.)

- In DecoderPro click the **New Loco** button.
- Scroll down the decoder list to **Tam Valley Depot**, expand it, select the **Quad-LN_S** family and expand it and then select **Quad-LN_S_v3** decoder. The screen should look like the image below. If the **Quad-LN_S_v3** decoder entry is missing, update JMRI per the recommendations in Section 2.2.3.
- Enter a unique **Roster ID** for the device such as QLN_North_Yard.
- Enter the desired Device Address in the **Active Address** field. Choose a unique address between 11001 and 16383. See Section 0 for information about Device Addresses. A unique address is required to avoid conflicts. Using a 5-digit address is recommended to avoid accidental changes to CVs from throttles.



- Click **Save** to add the entry to your Roster.
- Close the Create New Loco dialog by clicking the **X** in the upper right corner.

2.2.3 Set the Device Address in the QuadLN_S

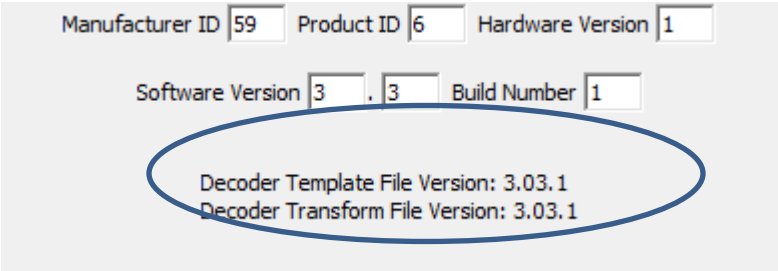
The Device Address of the QuadLN_S is set to 11000 by default and it needs to be changed now to match the value in the Roster Entry you just created.

- In DecoderPro click on the **Programming On Main** option.
- Select the roster entry you just created and then click the “Program…” button. The roster entry will open after a few seconds.
- Go to the **CVs** tab.
- Install the **ADDR** jumper on your *QuadLN_S*. The **ACTV** and **MSG** LEDs will start flashing alternately.
- **Write** CV17 and then **Write** CV18. (Ignore the “Programmer error” message, this is normal.) You must write the CVs in that order.

- The LEDs will stop flashing if the address was successfully changed. (If the LEDs are still flashing, check the Loconet connection to your computer and to the *QuadLN_S*. Then retry the previous step.)
- Remove the **ADDR** jumper.

REMINDER: Remember to **remove** the **ADDR** jumper when finished. Failure to remove the **ADDR** jumper can result in unintended changes to the Board Address.

When using *QuadLN_S* Firmware Version 3.3 or later, if the Decoder Template File Version is less than 3.03.1 or the Decoder Transform File version is less than 3.03.1 (shown towards the bottom of the Quad-LN_S tab) then please follow these steps to download and install the necessary template file.

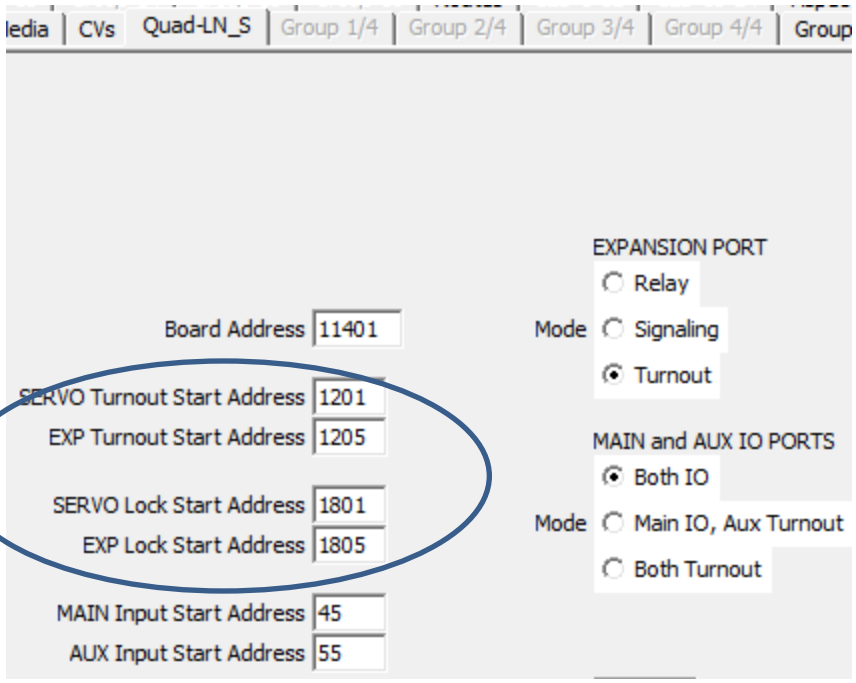


- Download the latest *QuadLN_S* update package from https://quadln.n3ix.com.
- Following the instructions in the readme file, copy the new decoder files and new tvd folder (if provided) into the appropriate locations.
- **Close** the Roster Entry if it is still open.
- Re-open the Roster Entry and recheck the Decoder File Versions.

2.3 Turnout Start Address, Lock Start Address, Main and Aux IO Start Addresses

Now we are ready to enter all other parameters of the *QuadLN_S*. To do this in JMRI we use **Ops-Mode / Programming On Main**.

- If the *QuadLN_S* Roster Entry is not already open for Programming On Main:
  - In DecoderPro click on the **Programming On Main** option.
  - Select the new *QuadLN_S* entry from the Roster and then click the "Program…" button. The roster entry will open after a few seconds.
- Go to the *QuadLN_S* tab.
- Click **Read full sheet** to read the firmware version information from the *QuadLN_S* into JMRI. The JMRI roster entry will adjust based on the *QuadLN_S* firmware version, so his step is important!



- Enter the desired SERVO port turnout start address in the **SERVO Turnout Start Address** field.
- Enter the desired EXP port turnout start address in the **EXP Turnout Start Address** field.
- (optional) Enter the desired SERVO lock start address in the **SERVO Lock Start Address** field.
- (optional) Enter the desired EXP lock start address in the **EXP Lock Start Address** field.
- (optional) Enter the desired Main IO start address in the **Main IO Start Address** field.
- (optional) Enter the desired Aux IO start address in the **Aux IO Start Address** field.
- Click **Write changes on sheet** to update the *QuadLN_S*.
- (recommended) Click **Read full sheet** to read back the address values and confirm the settings.
- Click **Save** on the **File** menu to update the roster entry.

3 Remote Align Board for Adjustment of Travel and Speed

The travel endpoints and speed for each servo can be set manually using the **Select**, **Up** and **Down** buttons on the Remote Alignment Board, or you can use JMRI. Here is the manual adjustment procedure.

1. Connect the Remote Align Board to the *QuadLN_S*.
2. Hold the **Select** button down until a numeric selection LED turns on (about 1 second), indicating that you are in Turnout Selection mode and that Turnout is selected. (The initial Turnout selection will be the same as the one selected the last time alignment was performed.)
3. An LED on the Remote Align Board indicates the selected Turnout using the following method:

Turnout	Remote Align LED indication
1-8	0-7 steady
9-16	0-7 flashing

   Use the **Up** and **Down** buttons to select the desired Turnout. Once the desired Turnout is indicated, press the **Select** button briefly.

4. The Closed LED is now flashing to indicate that the Turnout is in the CLOSED Position. For Servo outputs the Closed Position can be adjusted using the **Up** and **Down** buttons to move the Servo to the desired position. The servo position will change very slowly at first, so hold down the Up or Down button continuously when doing rough adjustment. When satisfied with the Closed Position, press the **Select** button briefly.
5. The Thrown LED is now flashing to indicate that the Turnout is in the THROWN Position. For Servo outputs the Thrown Position can be adjusted using the **Up** and **Down** buttons to move the Servo to the desired position. The servo position will change very slowly at first, so hold down the Up or Down button continuously when doing rough adjustment. When satisfied with the Thrown Position, press the Select button briefly.
6. The Speed LED is now flashing to indicate that the Speed is being adjusted. For Servo outputs the **Up** and **Down** buttons can be used to change the speed. The Servo will change position to demonstrate the new Speed. You can continue to adjust the speed while the Servo is moving if desired. When satisfied with the Speed, press the **Select** button briefly.
7. To readjust any of the parameters, press the **Select** button briefly to return to step 4.
8. For Servo outputs a brief press of both the **Select and Up** buttons simultaneously will center a servo at any point in the Alignment process. LED 7 (Ctr) will flash while the servo is centered. Press **Select** when finished to resume normal Align modes.

To exit the Adjustment process at any point, hold the Select button until the remote align board LEDs turn off (about 1 second). The new settings are now saved and in use.

4 Next Steps

See the manual for detailed information on how to configure the many features of the *QuadLN_S*. The *QuadLN_S* is an extremely capable product so there is a lot to explore!