



# *Programming DCC/Sound Decoders JMRI and DecoderPro*

Dave Duchamp



## *What is JMRI?*

JMRI (Java Model Railroading Interface) is open source (no cost) software for connecting a model railroad layout to a computer, and performing various model railroading tasks via the computer.

JMRI was/is developed by a group of volunteer programmers under the leadership of Bob Jacobsen.



## *How is JMRI Organized?*

JMRI has of an extensive library of model railroading software, and several front-end applications focusing on different areas of model railroading.

All JMRI applications use this common library.

JMRI Applications include:

**DecoderPro - Programming DCC decoders.**

PanelPro - Layout display for running trains.



# *What Computer Systems are Supported by JMRI?*

Windows – Windows 7, Vista, XP, 2000,  
98SE

Macintosh - MacOS X

Linux - several flavors

**Warning Note:** Version 3.0, scheduled for the summer of 2012, JMRI will no longer support some older Macintosh and Windows Systems.



## *What Model Railroading Systems are Supported by JMRI?*

Loconet - Digitrax (Chief, Empire Builder, Zephyr),  
Uhlenbrock - Intellibox

Lenz - LI100, LI100F, LI101, LIUSB

NCE Atlas Commander

C/MRI ZIMO MX-1 Roco

EasyDCC ZTC m-RPS

Wangrow Fleischmann Hornby

SPROG TMCC (Lionel) Protrak Grapevine

XPA Modem Oak Tree Systems **and More...**



# *What Model Railroading Tasks are Supported?*

## **Programming DCC decoders**

Computer Panel Displays (including full CTC Panel)

Computer throttles

Consisting

Control of Turnouts (Including Optional Feedback)

Routes (Controlling groups of Turnouts and/or Sensors)

Logix (Control and Automation Logic)

Control of Layout Lighting

Operations support (Switch Lists)

Control of Signals

**and Many More ...**



## *How do I get started?*

Detailed instructions for various computers and model railroading systems are on JMRI web site.

<http://jmri.org>

*No computer programming is required.*

**More information in your handout.**



# *Computer Connection Example*

Workshop system:

Digitrax DCS100

Locobuffer II

Serial to USB adapter

Macintosh MacBook Pro





# Configuration Panel

Preferences

**Connections**

- Defaults
- File Locations
- Start Up
- Display
- Messages
- Roster
- Throttle
- WiThrottle

**LocoNet** +

System manufacturer: Digitrax

System connection: LocoNet LocoBuffer-II

Settings:

Serial port: /dev/cu.usbserial-FTBQLF2A

Command station type: DCS100 (Chief)

Connection Prefix: L

Connection Name: LocoNet

Additional Connection Settings

Disable Connection

Save

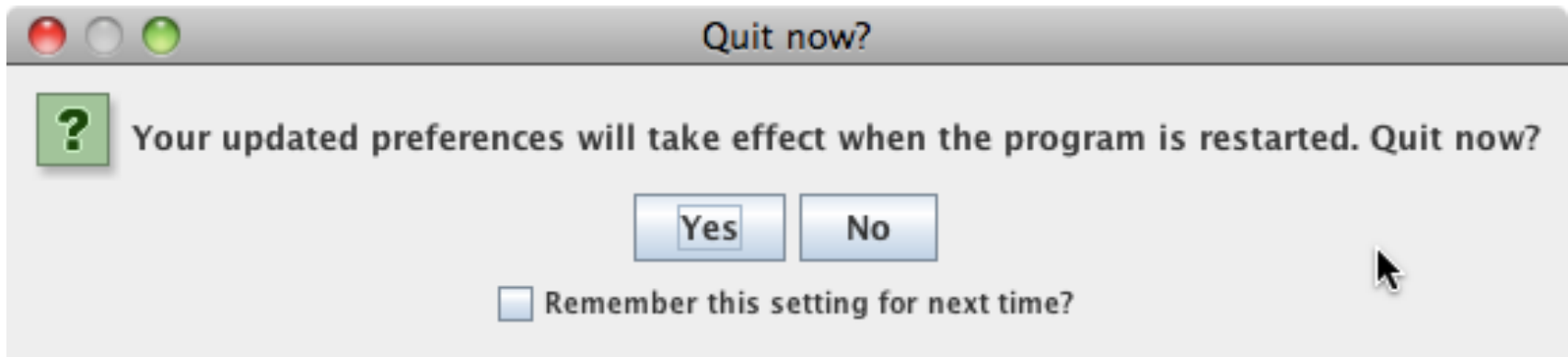
Delete Connection



- Select the type of layout connection from an extensive pull-down menu. Multiple connections are supported.
- Select configuration options for your layout connection.
- Set other startup options as desired by bringing up dialogs from the menu on the left.
- Click the “Save” button to write the connection configuration to disk.



Click the “Yes” button, to quit the program.  
Restart the JMRI application.



**Notes: Restart is required anytime preferences are changed for the preferences to take effect.**

**Preferences must be set for each JMRI application. They each have separate preferences files.**



The program is set up according to the saved preferences.



**Note: Startup window contains program version and Java version, in addition to connection information.**



# *How do I get help?*

1st - Most JMRI windows have a Help menu.

Window Help ... Documentation related to that window

General Help ... Overall JMRI documentation

2nd - The JMRI web site - <http://jmri.org/>

Documentation and detailed instructions

3rd - JMRI Yahoo discussion group. **jmriusers**

Monitored by JMRI 'experts', eager to provide help.

Information in your handout on how to sign up.



# *What is DecoderPro?*

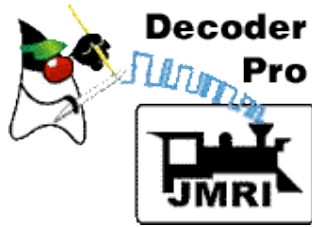
DecoderPro is a JMRI application.

DecoderPro is a better tool for programming DCC decoders.

DecoderPro simplifies the job of configuring complicated DCC decoders.

DecoderPro supports mobile decoders (decoders in locomotives).

DecoderPro supports some static decoders.



# *Basic Terminology*

**Decoder** - small microcomputer based control unit

**Mobile Decoder** - Decoder in a locomotive,  
“decodes” DCC commands to control locomotive.

**CV (Control Variable)** - 8-bit data byte in a decoder  
that specifies user options.

**Programming a Decoder** - setting the values of the  
CV's to user's options.

Decoders have many CV's. Many CV's follow  
**NMRA Standards**, but some are vendor specific.

Each mobile decoder has an **Address** - a number that  
allows the locomotive to be uniquely identified.



# *Setting up an Address*

Decoder (locomotive) addresses can be 2 digits or 4 digits on modern decoders and DCC throttles.

Usually set the address to the locomotive number.

Most decoders are set to address 03 on arrival.

A locomotive will respond to speed control and function commands that bear its address.

Setting the address is usually the first (and sometimes the only) programming needed.

**It's easy to set up an address in DecoderPro.**



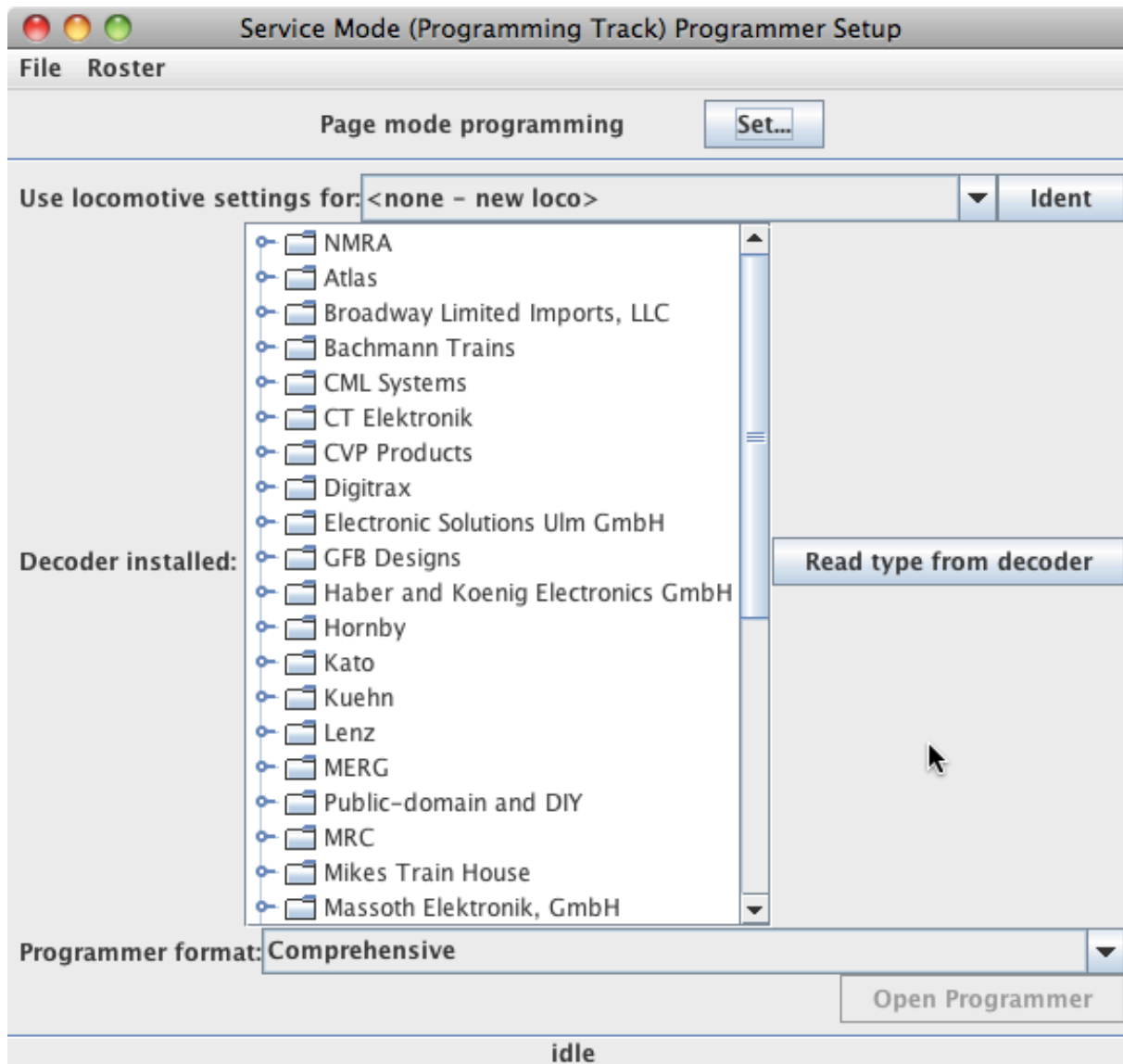


## *Example - Setting the address of a new decoder*

Put the locomotive with the new decoder on the programming track.

Start Decoder Pro. When the window below comes up, click  
**“Service Mode (Programming Track) Programmer”**

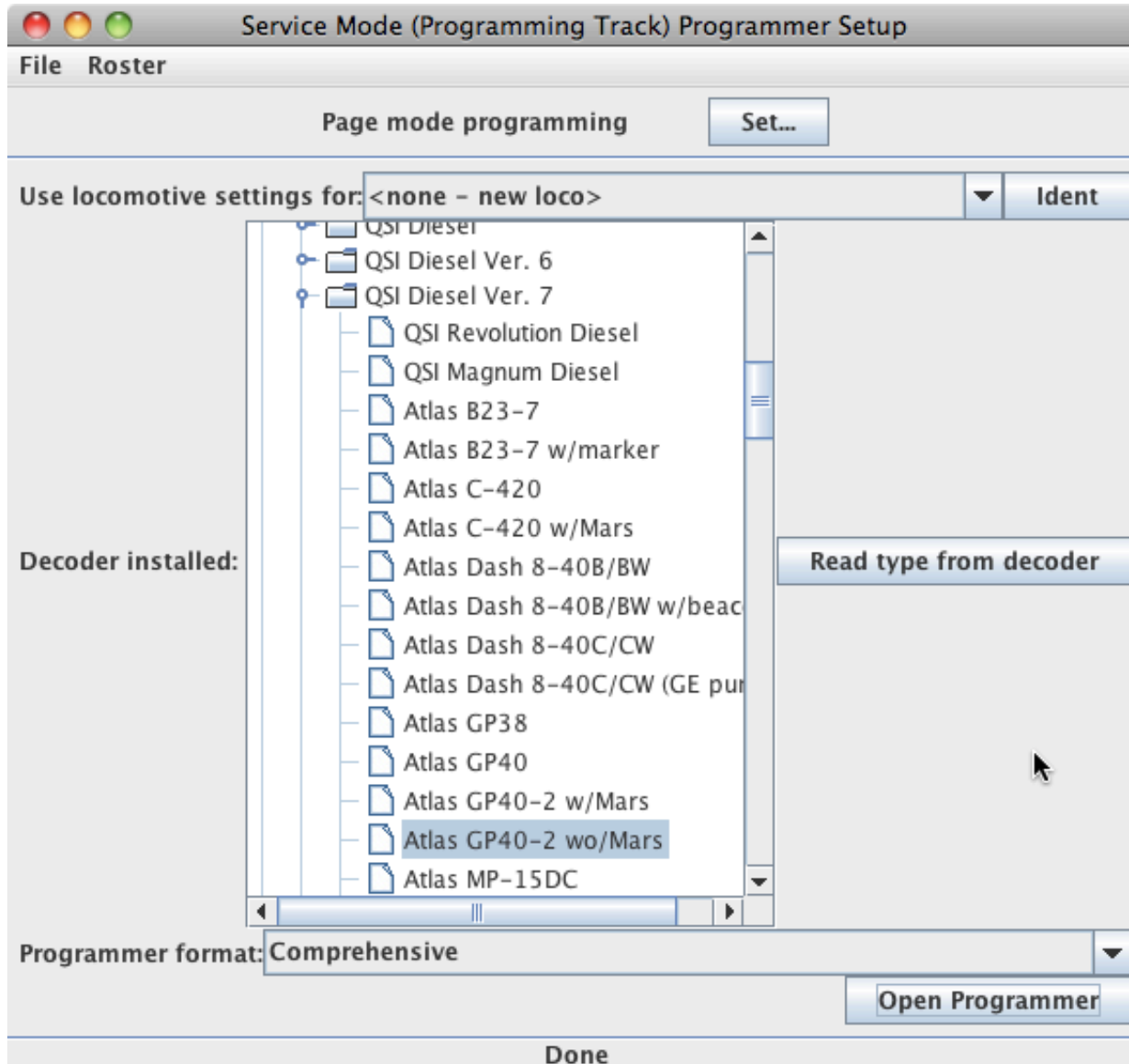
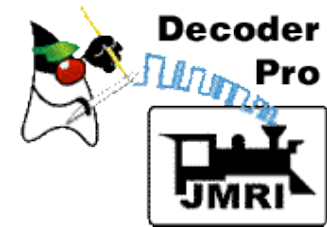




NMRA standards:  
Two CV's identify  
a decoder:  
CV8 - Manufacturer ID  
CV7 - Manufacturer  
Version Number.  
Both are **read only**.

<- Click here to have  
DecoderPro attempt to  
identify the decoder by  
reading these CV's.

**Note: Some command  
stations cannot read  
CV's! For these,  
select the decoder  
in the list manually.**



DecoderPro identified the decoder as a QSI Diesel Ver. 7 for an Atlas GP40-2 wo/Mars

**(Sometimes the user has to choose among several possibilities.)**

Click Atlas GP40-2 wo/Mars, to select it, and click “Open Programmer”.

<-



Fill in Roster information and click “Save to Roster”.

Program <new loco> in Service Mode (Programming Track)

File Reset Window Help

Function Output Light Control Multi Auto Lights BEMF Indexed CVs QSI Misc.  
Analog Controls Consist Advanced Sound Sound Levels CVs Sound Control Volume  
Roster Entry Basic Motor Basic Speed Control Speed Table Function Map Lights

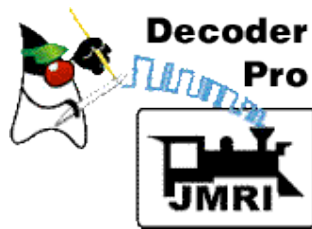
ID: <new loco>  
Road Name:  
Road Number:  
Manufacturer:  
Owner:  
Model:  
DCC Address:  
Throttle Speed Limit (%): 100  
Comment:  
Decoder Family: QSI Diesel Ver. 7  
Decoder Model: Atlas GP40-2 wo/Mars  
Decoder Comment:  
Filename:  
Date Modified:

Save to Roster Reset to defaults

Read changes on all sheets Write changes on all sheets Read all sheets Write all sheets

Direct byte mode programming Set...

idle



Click the Basic tab.

Program <new loco> in Service Mode (Programming Track)

File Reset Window Help

Function Output | Light Control | Multi Auto Lights | BEMF | Indexed CVs | QSI Misc.  
Analog Controls | Consist | Advanced | Sound | Sound Levels | CVs | Sound Control | Volume  
Roster Entry | **Basic** | Motor | Basic Speed Control | Speed Table | Function Map | Lights

ID:	GT6419
Road Name:	GT 6419
Road Number:	6419
Manufacturer:	Atlas Gold Line
Owner:	Dave Duchamp
Model:	GP40-2
DCC Address:	6419 Long
Throttle Speed Limit (%):	100
Comment:	Came with decoder installed.
Decoder Family:	QSI Diesel Ver. 7
Decoder Model:	Atlas GP40-2 wo/Mars
Decoder Comment:	
Filename:	
Date Modified:	Jul 8, 2010 10:06:32 AM

Save to Roster | Reset to defaults

Read changes on all sheets | Write changes on all sheets | Read all sheets | Write all sheets

Direct byte mode programming | Set...

Roster file GT6419.xml saved OK



Click “Read full sheet”. Yellow items are replaced with values read from the decoder.

Program <new loco> in Service Mode (Programming Track)

File Reset Window Help

Function Output | Light Control | Multi Auto Lights | BEMF | Indexed CVs | QSI Misc.  
Analog Controls | Consist | Advanced | Sound | Sound Levels | CVs | Sound Control | Volume  
Roster Entry | Basic | Motor | Basic Speed Control | Speed Table | Function Map | Lights

One byte (short) address  
 Two byte (extended) address

Active DCC Address: 3

Primary Address 3  
Extended Address 0  
Address Format One byte (short) address

Locomotive Direction normal  
FL Location 28/128 speed step format  
Power Source Conversion DC conversion enabled

Manufacturer ID 113  
Manufacturer Version No 0  
Product Model 0

Read changes on sheet | Write changes on sheet | Read full sheet | Write full sheet  
Read changes on all sheets | Write changes on all sheets | Read all sheets | Write all sheets

Direct byte mode programming Set...

Roster file GT\_8419.xml saved OK



Switch off analog, and set new two-byte address.  
Click “Write changes on sheet” to send to loco.

Program <new loco> in Service Mode (Programming Track)

File Reset Window Help

Function Output | Light Control | Multi Auto Lights | BEMF | Indexed CVs | QSI Misc.  
Analog Controls | Consist | Advanced | Sound | Sound Levels | CVs | Sound Control | Volume Lights  
Roster Entry | Basic | Motor | Basic Speed Control | Speed Table | Function Map | Lights

One byte (short) address  
 Two byte (extended) address

Active DCC Address: 6419

Primary Address 3  
Extended Address 6419  
Address Format Two byte (extended) address ▼

Locomotive Direction normal ▼  
FL Location 28/128 speed step format ▼  
Power Source Conversion NMRA Digital only ▼

Manufacturer ID 113  
Manufacturer Version No 7  
Product Model 174

Read changes on sheet | Write changes on sheet | Read full sheet | Write full sheet  
Read changes on all sheets | Write changes on all sheets | Read all sheets | Write all sheets

Direct byte mode programming Set...

OK



Return to Roster Entry and “Save to Roster”  
to update Roster on disk. **All done!**

Program <new loco> in Service Mode (Programming Track)

File Reset Window Help

Function Output Light Control Multi Auto Lights BEMF Indexed CVs QSI Misc.  
Analog Controls Consist Advanced Sound Sound Levels CVs Sound Control Volume  
Roster Entry Basic Motor Basic Speed Control Speed Table Function Map Lights

ID: GT6419  
Road Name: GT 6419  
Road Number: 6419  
Manufacturer: Atlas Gold Line  
Owner: Dave Duchamp  
Model: GP40-2  
DCC Address: 6419 Long  
Throttle Speed Limit (%): 100  
Comment: Came with decoder installed.  
Decoder Family: QSI Diesel Ver. 7  
Decoder Model: Atlas GP40-2 wo/Mars  
Decoder Comment:  
Filename:  
Date Modified: Jul 8, 2010 9:23:46 AM

Save to Roster Reset to defaults

Read changes on all sheets Write changes on all sheets Read all sheets Write all sheets

Direct byte mode programming Set...

OK





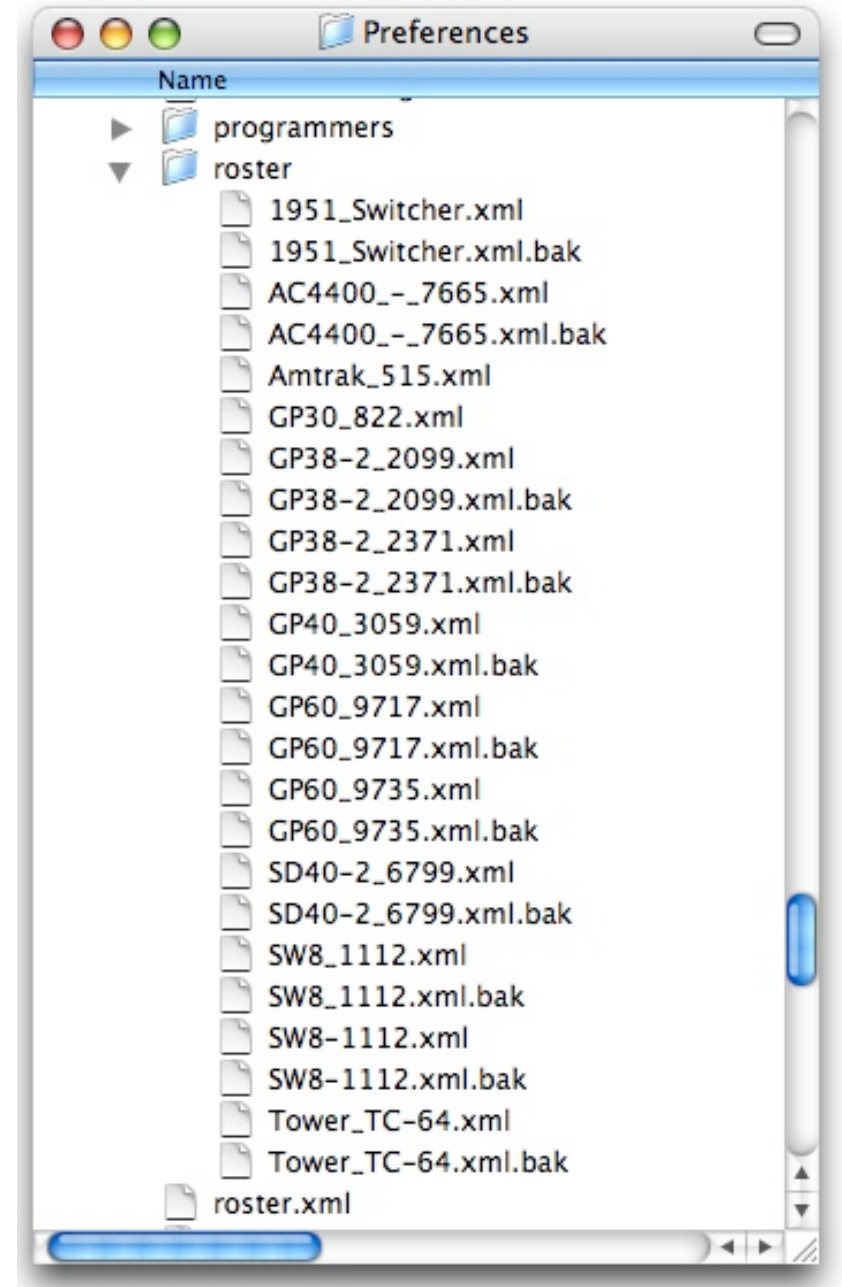
## *What are Roster Files?*

DecoderPro stores the final information for each decoder in a **Roster File**.

These Roster Files are used to construct a Roster menu for JMRI applications.

A Roster file allows easy reprogramming if decoder needs to be reset.

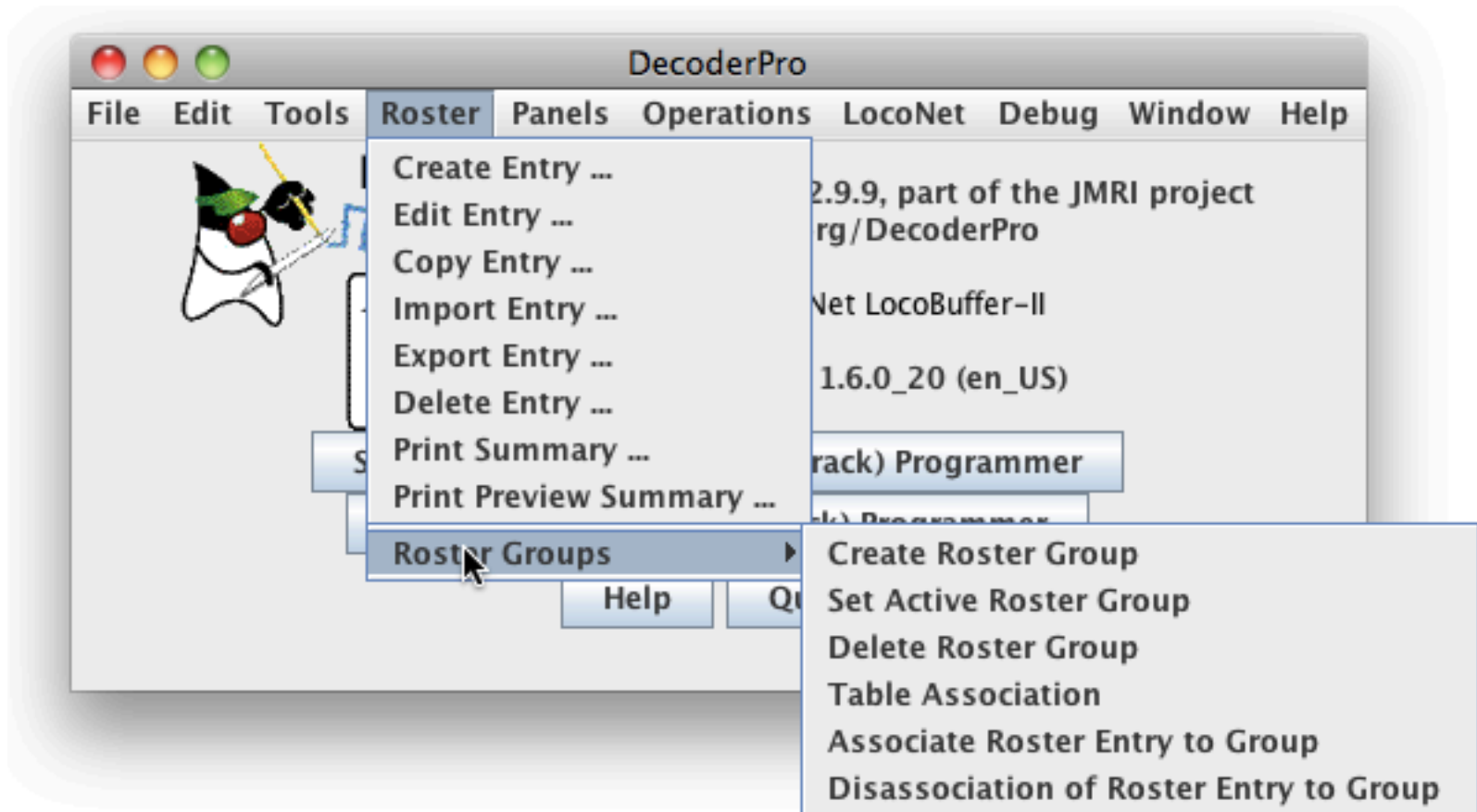
The Roster menu allows easy selection of a loco in JMRI tools--decoder programmer, throttle, consist, etc.





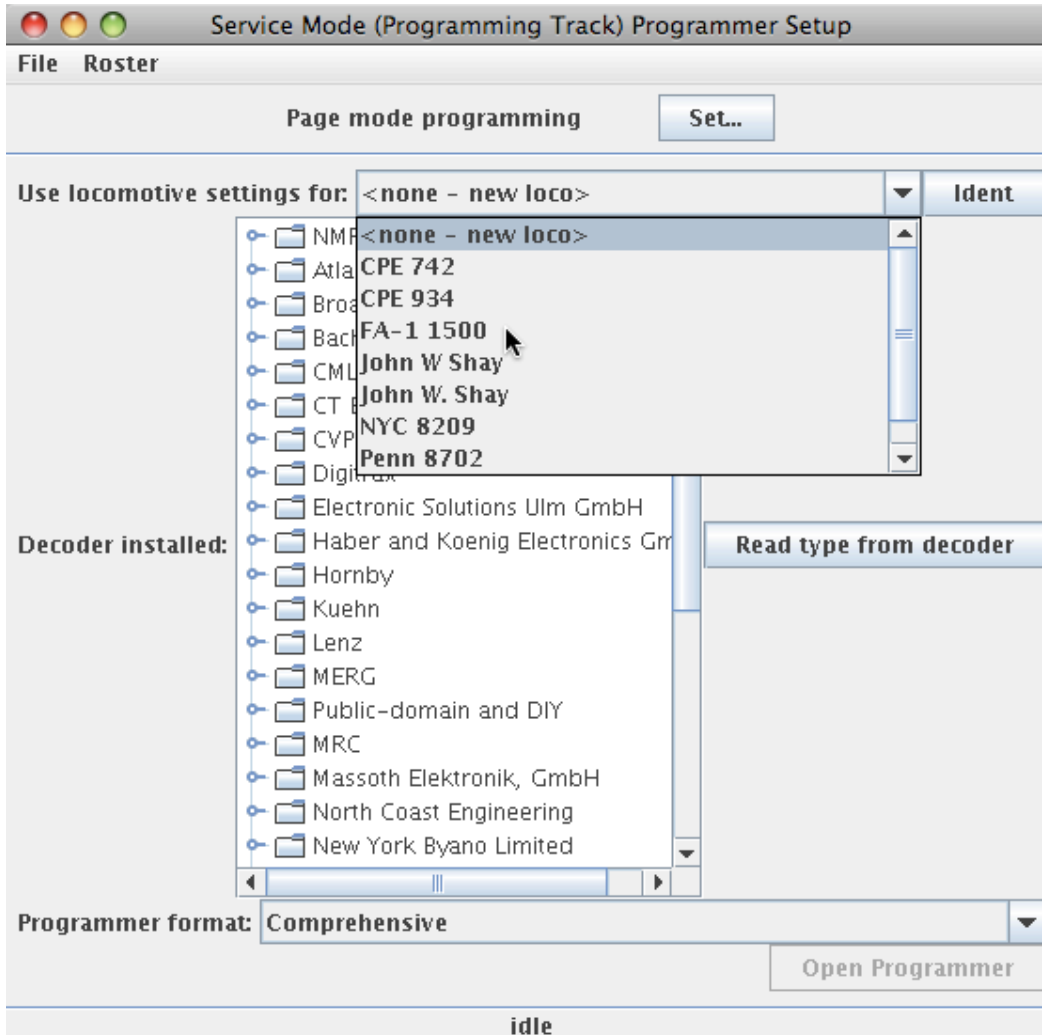
# *Roster Menu*

## *Roster Groups*





# Changing a decoder's programming



Select loco from Roster

- or -

<- Click “Ident” to have DecoderPro read the loco address and find it in the Roster.

After loco is identified, click “Open Programmer”

**Note: “Open Programmer” is not active until a decoder is identified.**

<-



The saved information is back!  
Click “Basic Speed Control”.

Program FA-1 1500 in Service Mode (Programming Track)

File Reset Window Help

Lights Analog Controls Consist Advanced Sound Sound Levels CVs

Roster Entry Function Labels Basic Motor Basic Speed Control Speed Table Function Map

ID: FA-1 1500  
Road Name: UP 1500  
Road Number: 1500  
Manufacturer: Walthers Trainline  
Owner: Dave Duchamp  
Model: ALCO FA-1  
DCC Address: 1500 Long  
Comment:  
Decoder Family: Basic STD  
Decoder Model: DH121  
Decoder Comment:  
Filename: FA\_1\_1500.xml

Save to Roster Reset to defaults

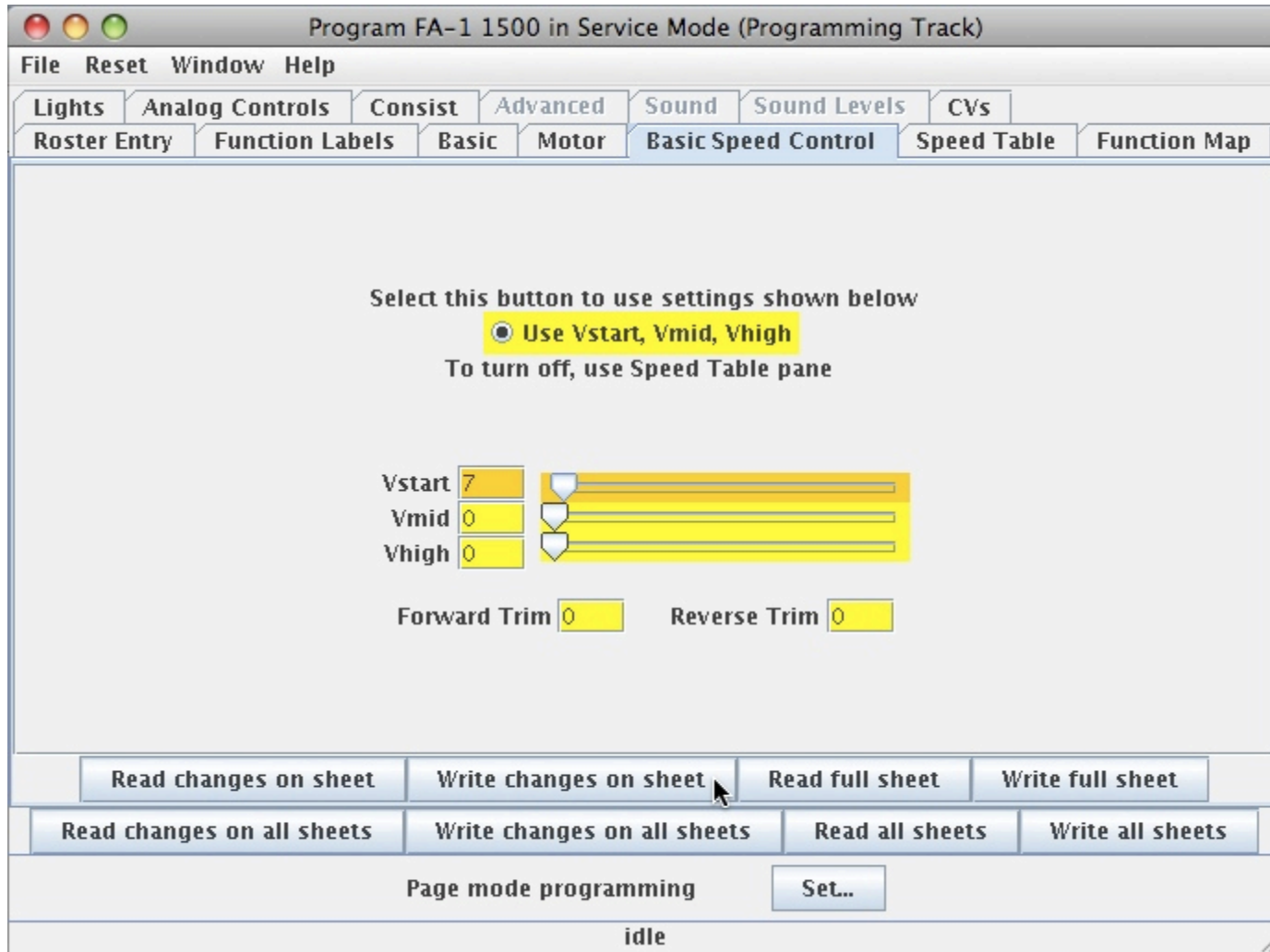
Read changes on all sheets Write changes on all sheets Read all sheets Write all sheets

Page mode programming Set..

idle



Yellow color indicates the values are from the Roster file. Orange - changed, but not written to decoder.



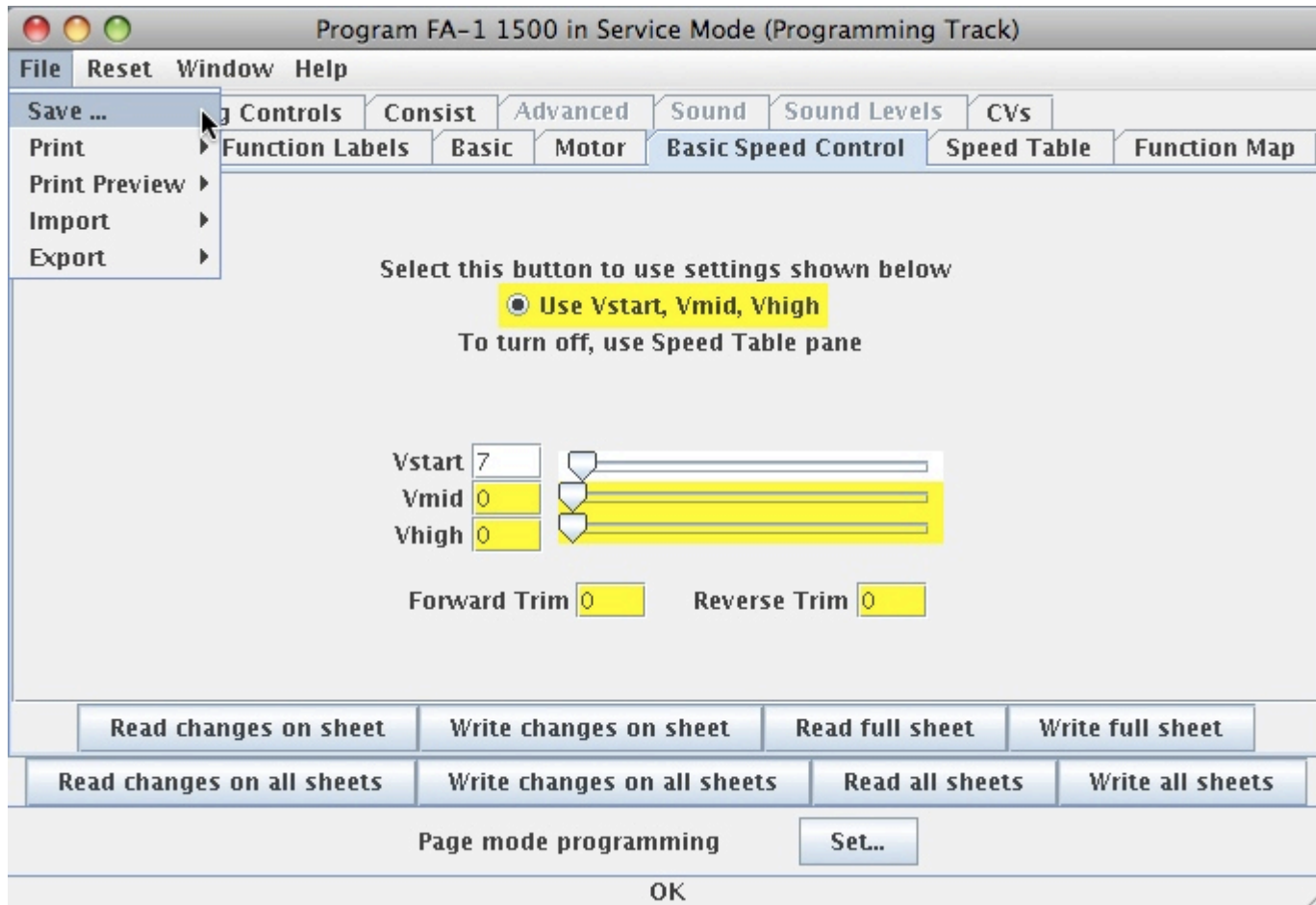
Enter a value in “Vstart”.

Click “Write changes on sheet”





Changed Vstart was written to the decoder.  
Select File>Save... to save the change to disk.



**It's done.**

**Go run the loco!**



# *Miscellaneous Info and Tips*

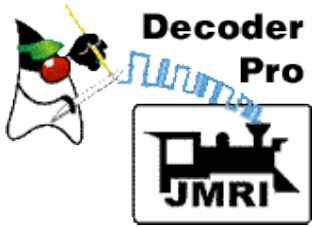
Support for new decoders is continuously added to DecoderPro.

DecoderPro works through the command station, so it's usually limited to what you can do with your throttle. **Think of DecoderPro as a smart throttle.**

DecoderPro supports other modes of programming. Access these other modes using the “Set...” button to get the dialog shown at the right. **Some decoders need a different mode for programming.**



Some new sound decoders need a programming track booster to communicate with some command stations.



## *Example: Procedure for Speed Matching Engines for Consists*

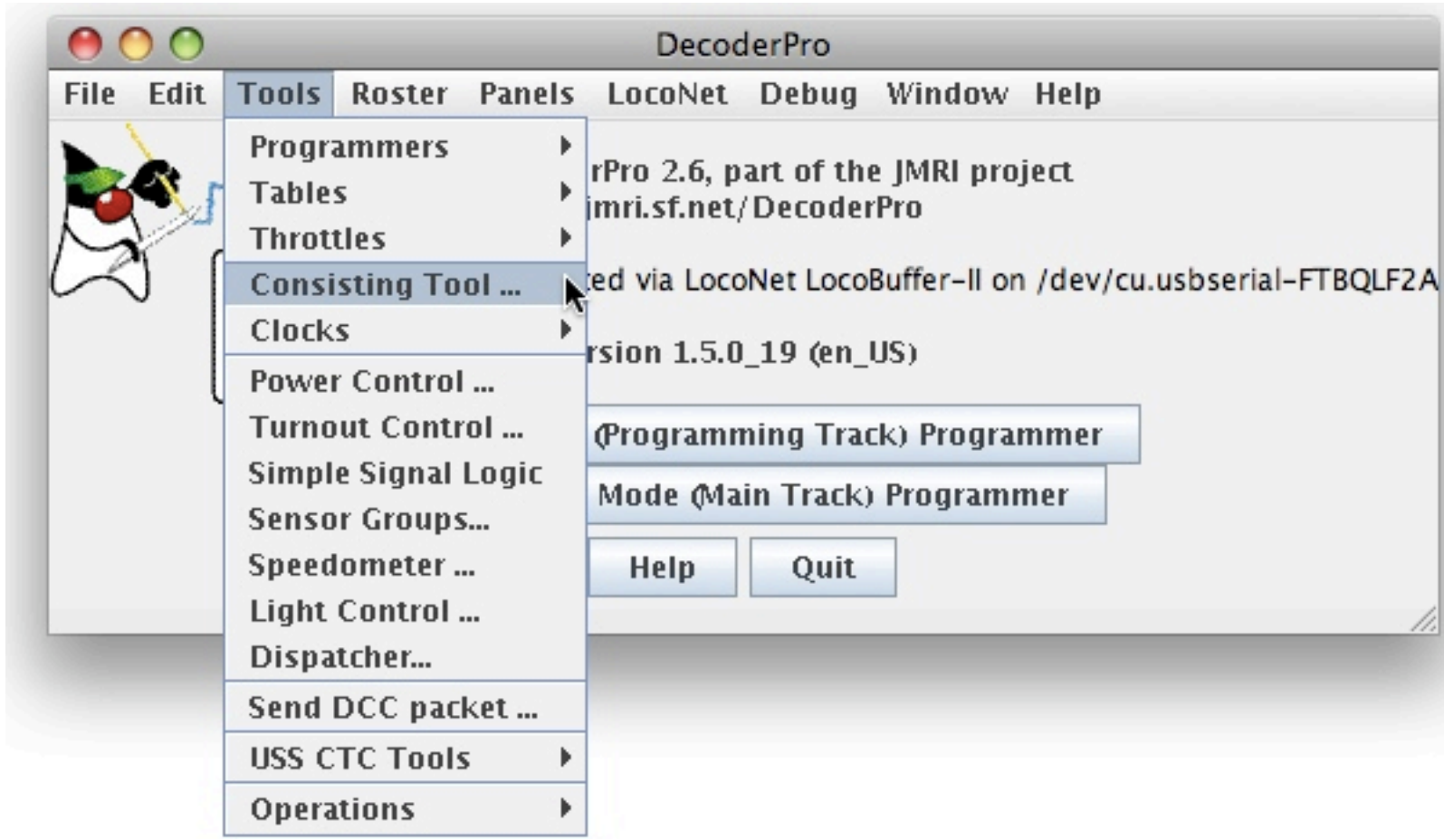
Object: To match the speed of two or more engines.

1. Preliminary: Determine which engine runs slowest. Warm up engines (3-4 minutes).
2. Make sure wheels and track are clean!
3. Make sure all engines have DecoderPro roster files, and start speeds are set.
4. Make a consist with your slowest engine as the lead engine. **Do not couple the engines.**



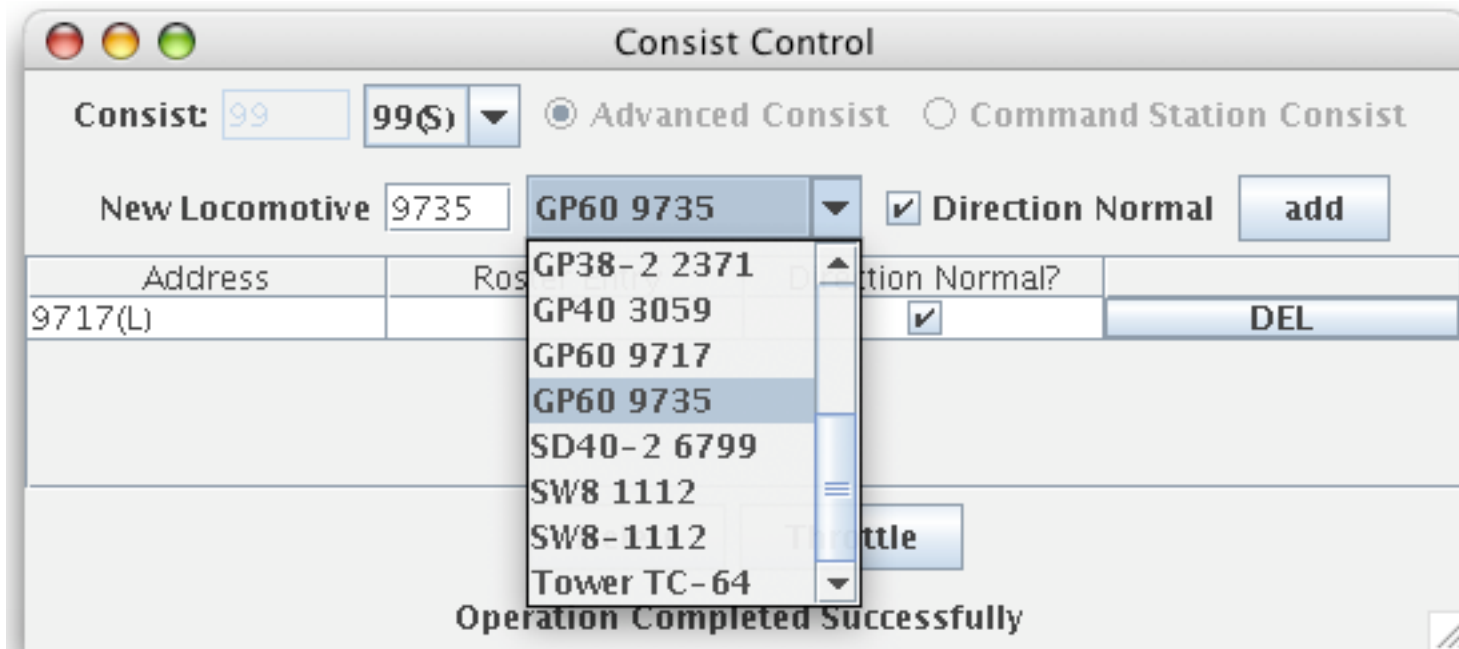


Select the JMRI Consisting Tool.



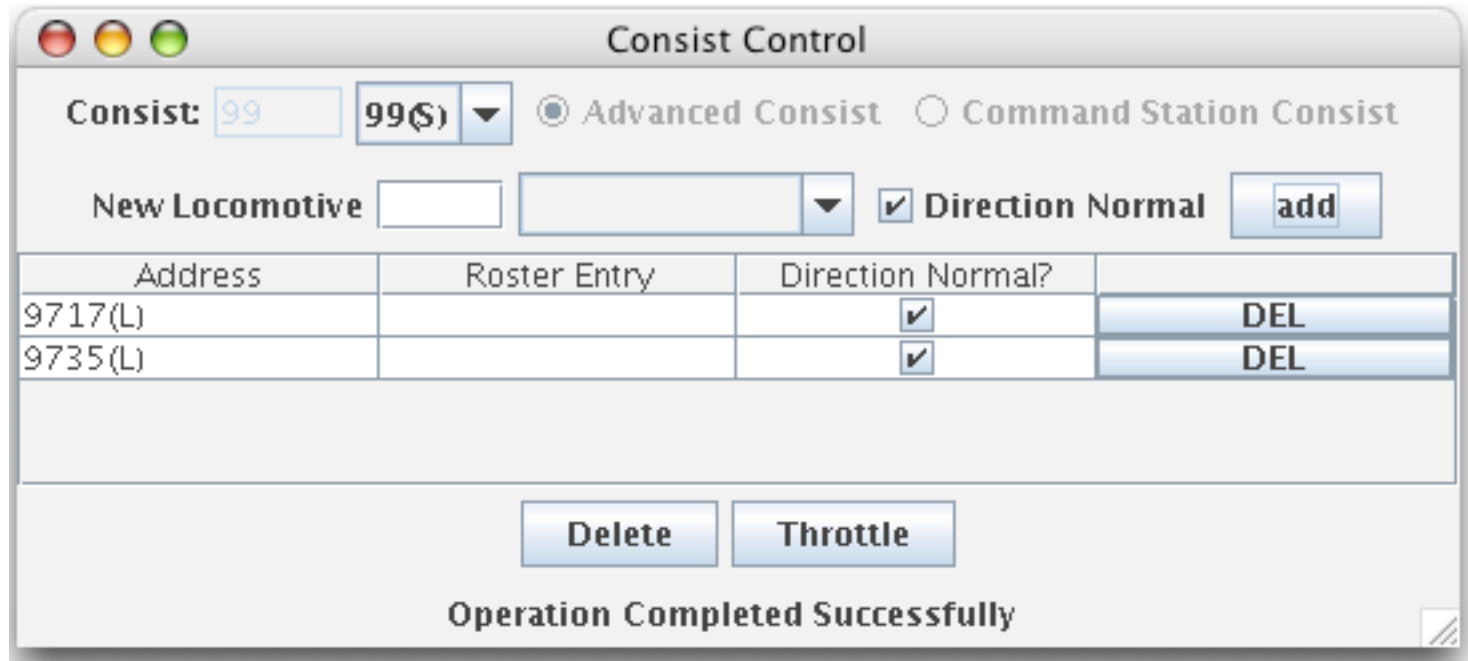


Give the new consist a two-digit address, and add the two engines to the table for the new consist, the slowest first.





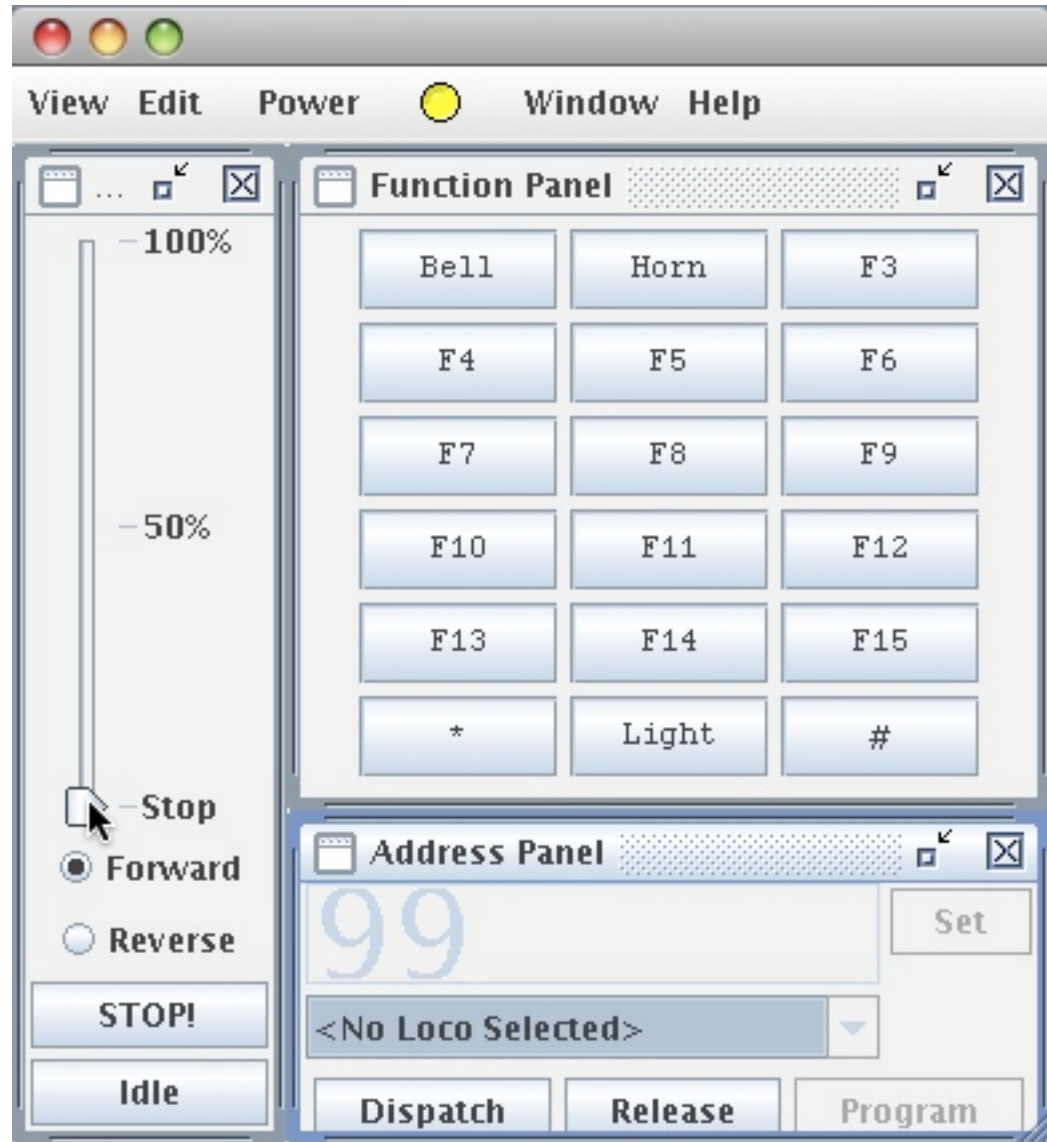
After locomotives are in the table, hit the “Throttle” button to make the consist and open a new JMRI Throttle to control it.

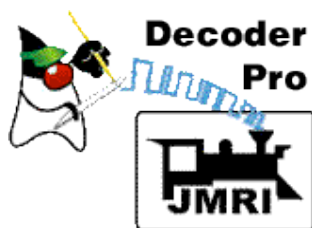




You can now run  
the consist using this  
throttle.

**Remember: Do not  
couple the locos.  
Space them about  
12 inches apart.**





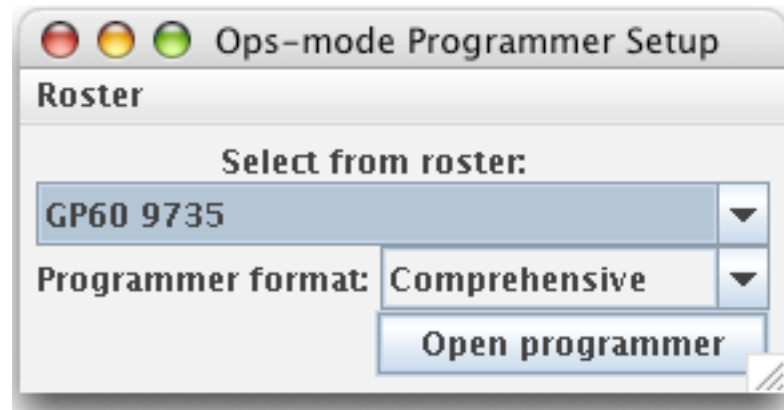
## 4. Open a programmer for the faster loco in DecoderPro using “Ops mode”.

Select “Operations Mode (Main Track) ...”





Select the roster entry for the faster loco, and click “Open Programmer”.





## 5. Slow the faster loco using the decoder speed table.

Select the “Speed Control” tab. (“Speed Table” tab on current version)

Program GP60 9735 on main track

File

Analog Controls   Consist   Advanced   Sound   Sound Levels   CVs   Digitrax

Roster Entry   Basic   Motor   **Speed Control**   Function Map   Lights

ID: GP60 9735

Road Name: SP 9735

Road Number: 9735

Manufacturer: Lifelike Proto 2000

Owner: Dave Duchamp

Model: GP60

DCC Address: 9735   Long ▾

Comment:

Decoder Family: Series 3 with FX3, silent, readback

Decoder Model: DH163L0

Decoder Comment: Number board light hooked to F1

Filename: GP60\_9735.xml

Save

Reset to defaults

Read changes on all sheets   Write changes on all sheets   Read all sheets   Write all sheets

idle



Select “Use Table”, and reduce the value in the 28th (last) step of the speed table. Click “Match Ends” to adjust all steps.

The screenshot shows the Decoder Pro software interface for editing a speed table. The window title is "Program GP60 9735 on main track". The "Speed Control" tab is active, showing "Forward Trim" and "Reverse Trim" both set to 128. The "Use Table" radio button is selected. The speed table has 28 steps, with the last three steps (26, 27, 28) highlighted in yellow and set to a value of 234. The "Match ends" button is highlighted in blue. Other buttons include "Force Straight", "Constant ratio curve", "Log curve", "Shift left", and "Shift right". At the bottom, there are buttons for "Read changes on sheet", "Write changes on sheet", "Read full sheet", "Write full sheet", "Read changes on all sheets", "Write changes on all sheets", "Read all sheets", and "Write all sheets". An "OK" button is at the very bottom.

Program GP60 9735 on main track

File

Lights Analog Controls Consist Advanced Sound Sound Levels CVs Digitrax

Roster Entry Basic Motor Speed Control Function Map

max volts

Forward Trim 128 Reverse Trim 128

Use Table

Speed Table

8	17	26	35	44	53	62	72	81	90	99	108	117	126	136	145	154	163	172	181	190	200	209	218	227	234	234	234
---	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Force Straight Match ends Constant ratio curve Log curve Shift left Shift right

Read changes on sheet Write changes on sheet Read full sheet Write full sheet

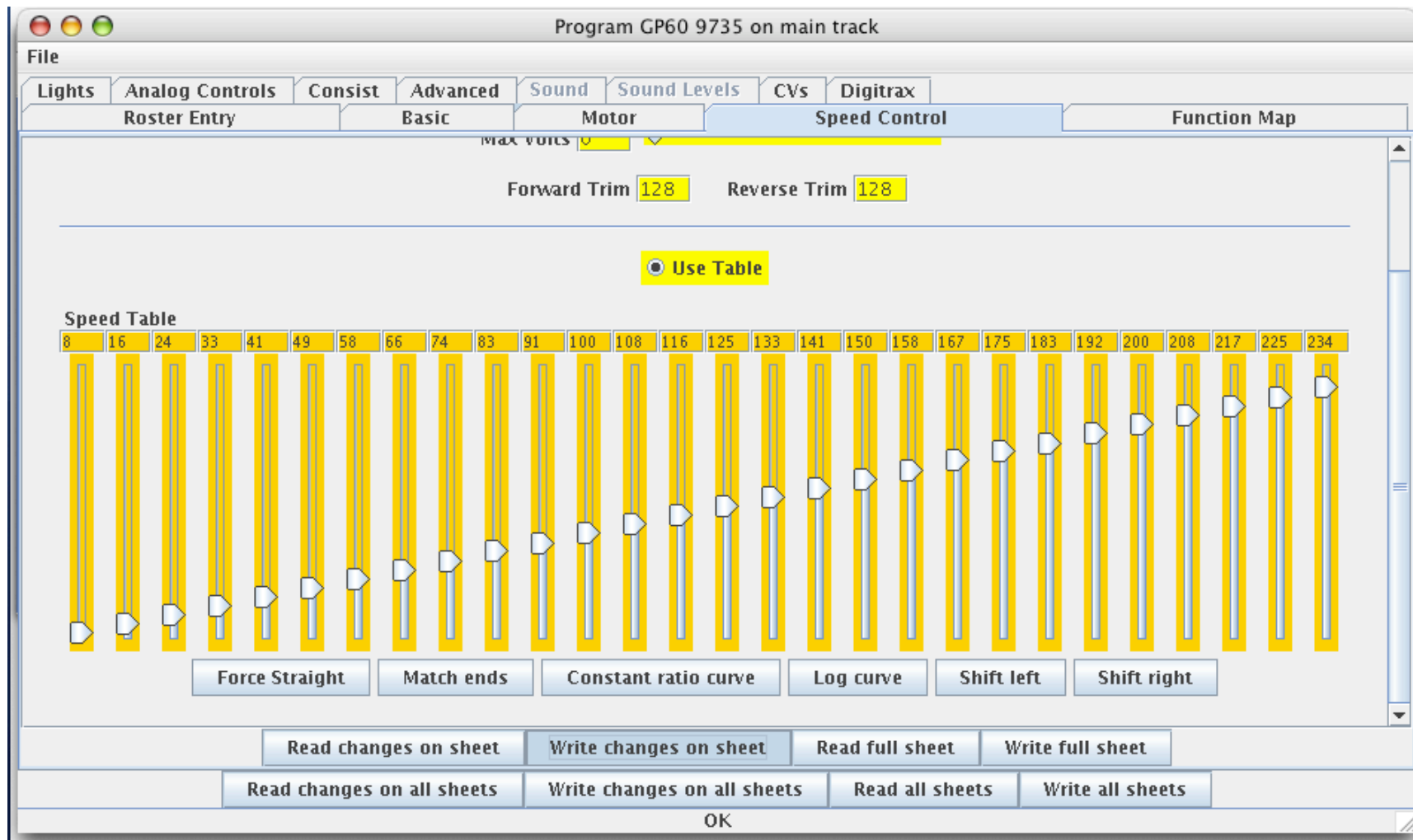
Read changes on all sheets Write changes on all sheets Read all sheets Write all sheets

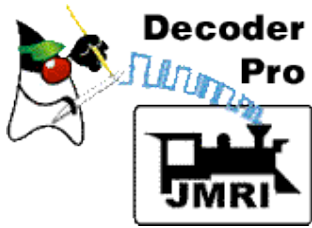
OK





Click “Write changes on sheet” to send the new table to the decoder.





As each step is written, DecoderPro indicates progress as shown below.

Program GP60 9735 on main track

File

Lights Analog Controls Consist Advanced Sound Sound Levels CVs Digitrax

Roster Entry Basic Motor Speed Control Function Map

Max Volts 0

Forward Trim 128 Reverse Trim 128

Use Table

Speed Table

8	15	23	31	38	46	54	61	69	77	84	92	100	107	115	123	130	138	146	153	161	169	176	184	192	199	207	215	
<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>	<input type="range"/>

Force Straight Match ends Constant ratio curve Log curve Shift left Shift right

Read changes on sheet Stop Write changes on sheet Read full sheet Write full sheet

Read changes on all sheets Write changes on all sheets Write highlighted values on this sheet to decoder Write all sheets

Writing CV82...



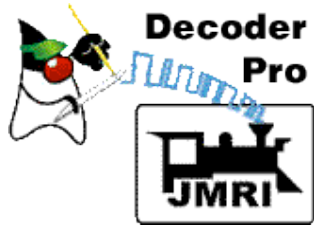
## **6. Continue to adjust speed table until loco runs the same speed as the lead engine.**

Run consist the same speed each trial (50% works well).

Stop consist between speed table adjustments if the speeds are much different.

Note: When programming on the main, CV's usually cannot be read--only written!

**Remember to Save the roster file when done.**



# Sound Decoder Demo

## DecoderPro Animated Demos:

Peter Ulvestad (Edmonton Model Railroad Association)

<http://www3.telus.net/public/ulvestad/DecoderProDemos.html>

