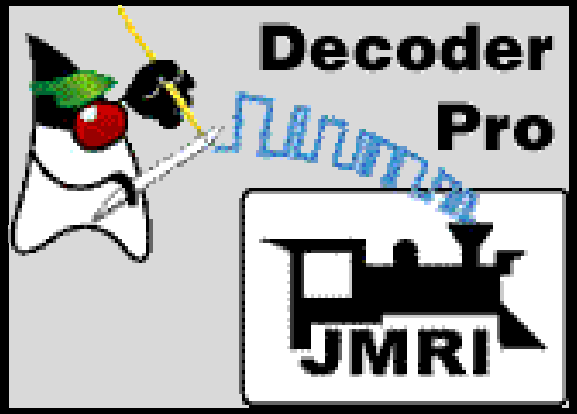

JMRI DecoderPro

A conceptual overview

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Outline

- **Conceptual** overview of **JMRI** and **DecoderPro**
- Not a lot of detail
- **Won't** teach you how to use it
- **Will** try to explain why you would want it
- How DecoderPro fits into a typical DCC system
- Examples are from my Digitrax system

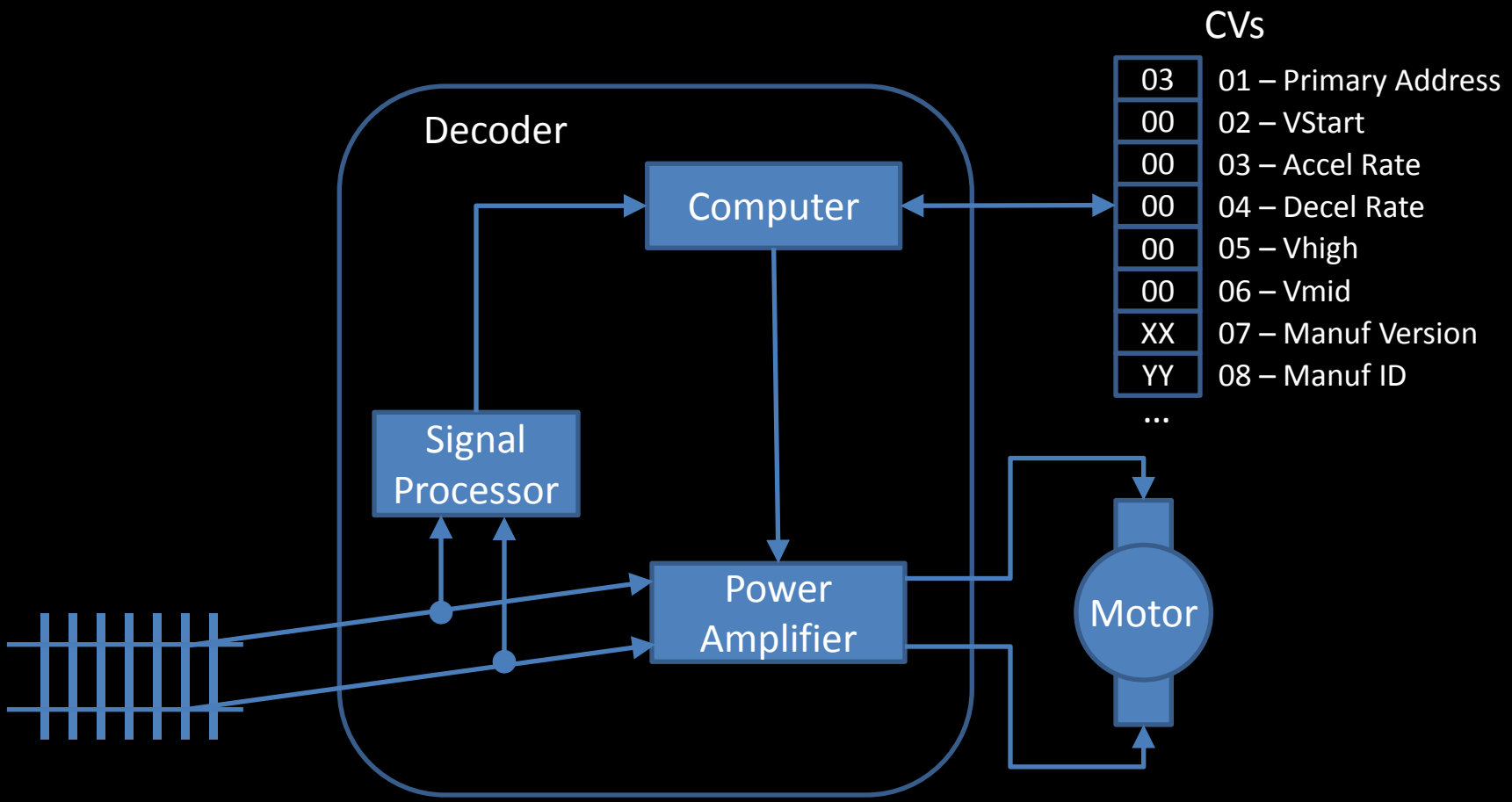
Decoder Programming 101

- Programming a decoder changes its **behaviour**
  - Simplest is its primary address
- Done with values stored in **Control Variables**
- All DCC systems *can* program decoders
- DecoderPro makes this **much** easier

Control Variables (CVs)

- Everything controlled by so-called **CV** values
  - CV = Configuration Variable = just a number
  - 1024 CVs allowed by NMRA standard
- Values range from 0 – 255 (1 byte, 8 bits)
  - e.g. CV 1 is the primary (short) address (1 – 127)
- Some are very complex
  - e.g. CV 29 holds 8 different things!

Decoder Architecture



Programming using a DCC System

- All systems can program any decoder
- Basic operation is to write a value into a CV
- That's it!
- Some will help with complex CVs like the long address in CV 17-18
- Simple in principle, but a **LOT** of details for you to sort out and keep track of
- This is where **DecoderPro** comes in…

What is Decoder Pro?

- A fancy piece of software that turns your **computer** into a **DCC throttle**
- **That's it!**
- …but a ***Very*** sophisticated throttle

Why use DecoderPro?

- Why use it if your DCC system will work?
- Helps Identify decoders
- Displays CVs and their values with understandable names
- Allows all CV values to be stored in a **roster** file
- Various aids for selecting values (speed tables)
- Lets you think in **locomotive terms**, instead of just a bunch of numbers
- And a whole lot more!

CV 29 Example

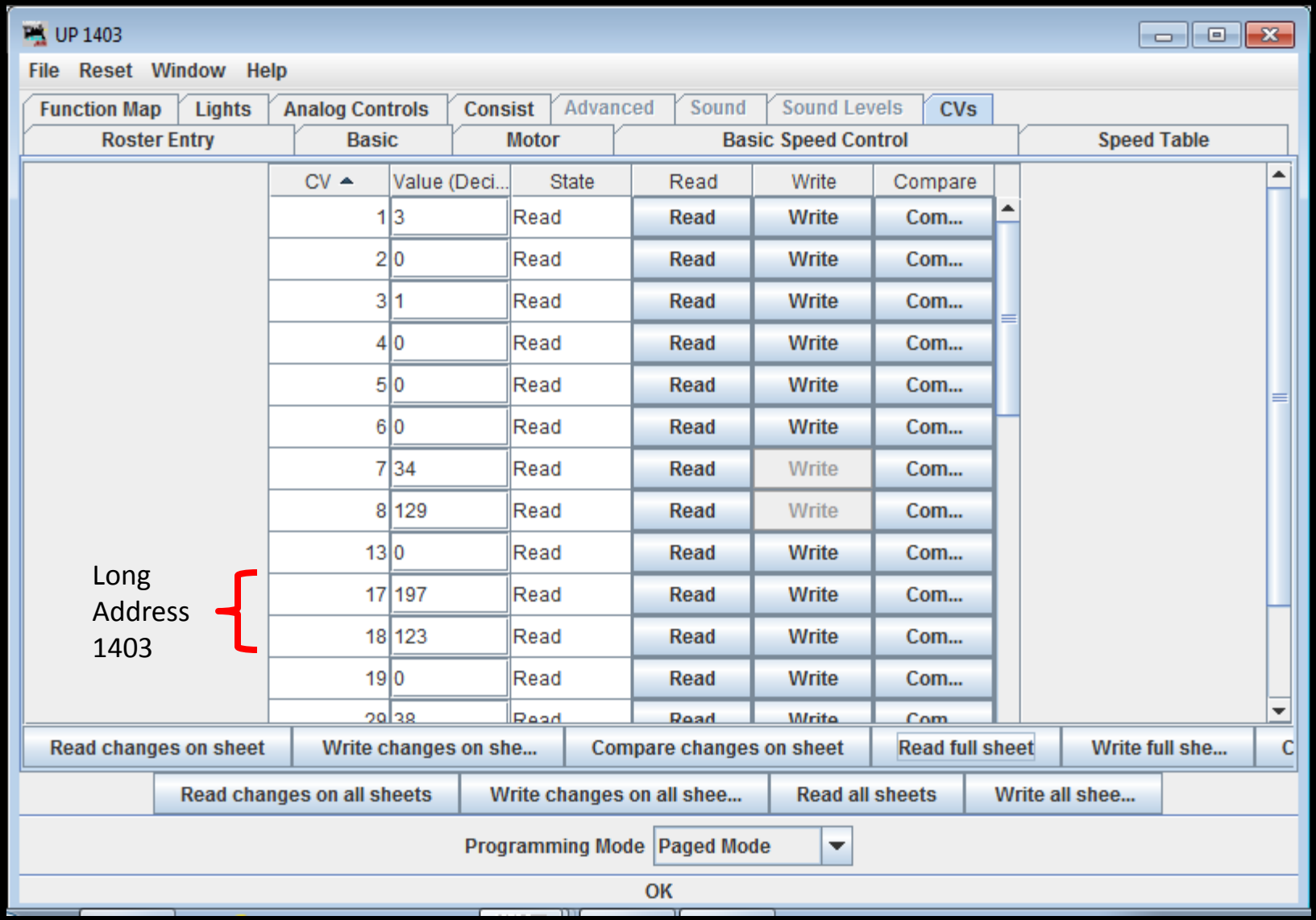
- Holds **8 different things**, one per bit.
  - Bit 0 = **Locomotive Direction**: "0" = normal, "1" = reversed. This bit controls the locomotive's forward and backward direction in digital mode only. Directional sensitive functions, such as headlights (FL and FR), will also be reversed so that they line up with the locomotive's new forward direction. See S-9.1.1 for more information.
  - Bit 1 = FL location: "0" = bit 4 in Speed and Direction instructions control FL, "1" = bit 4 in function group one instruction controls FL. See S-9.2.1 for more information.
  - Bit 2 = **Power Source Conversion**: "0" = NMRA Digital Only, "1" = Power Source Conversion Enabled, See CV#12 for more information,
  - Bit 3 = Bi-Directional Communications: "0" = Bi-Directional Communications disabled, "1" = Bi-Directional Communications enabled. See S-9.3.2 for more information.
  - Bit 4 = **Speed Table**: "0" = speed table set by configuration variables #2,#5, and #6, "1" = Speed Table set by configuration variables #66-#95
  - Bit 5 = "0" = **one byte addressing**, "1" = **two byte addressing** (also known as extended addressing), See S 9.2.1 for more information.
  - Bit 6 = Reserved for future use.
  - Bit 7 = Accessory Decoder: "0" = Multifunction Decoder, "1" = Accessory Decoder

- **Simple, isn't it**!

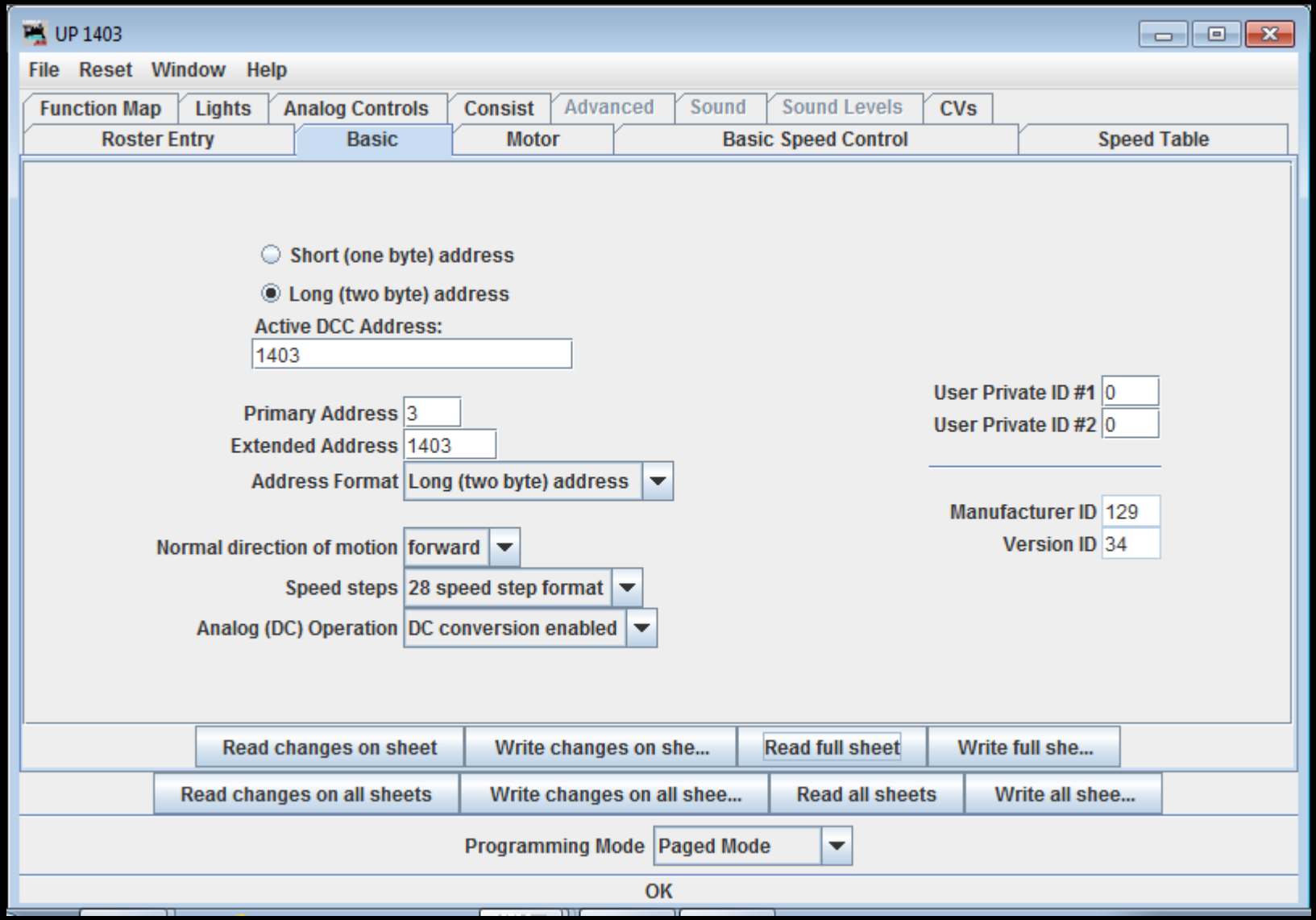
Long Address in CV 17 & CV 18

- CVs can only store between 0 – 255
- Long addresses, up to 9999, need two CVs
- Not a simple format!
- Example, address 1403
  - 1403 = 0x057B, but 2 high bits must be ones
  - Therefore, 0xC57B -> 0xC5 and 0x7B
  - CV 17 = 0xC5 (most significant bits)
  - CV 18 = 0x7B (least significant bits)
  - In decimal, 0xC5 = **197**, and 0x7B = **123**
- Again, Simple, isn't it!

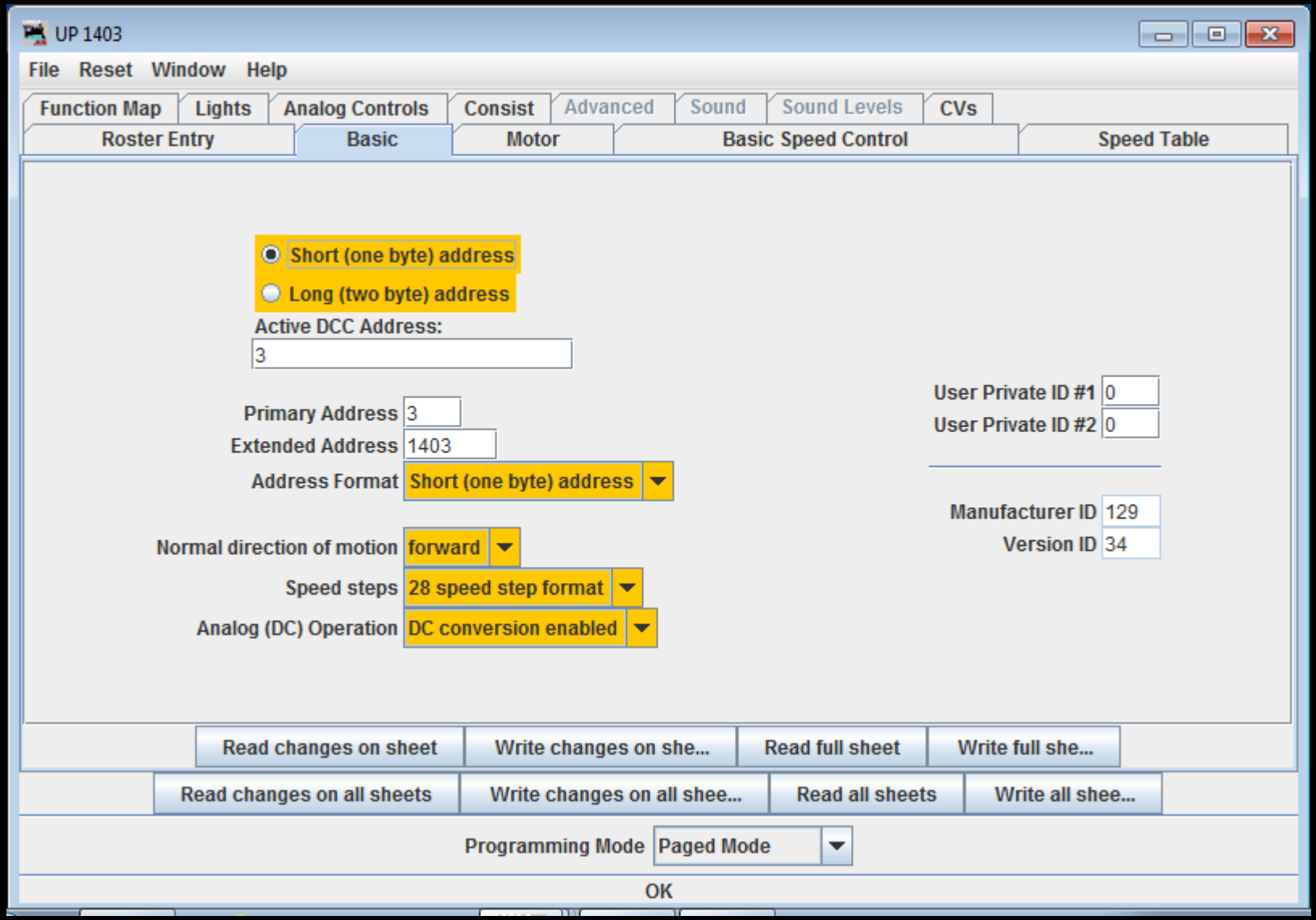
Direct Editing of CVs



Long Address & CV 29 in DecoderPro



Long Address & CV 29 in DecoderPro



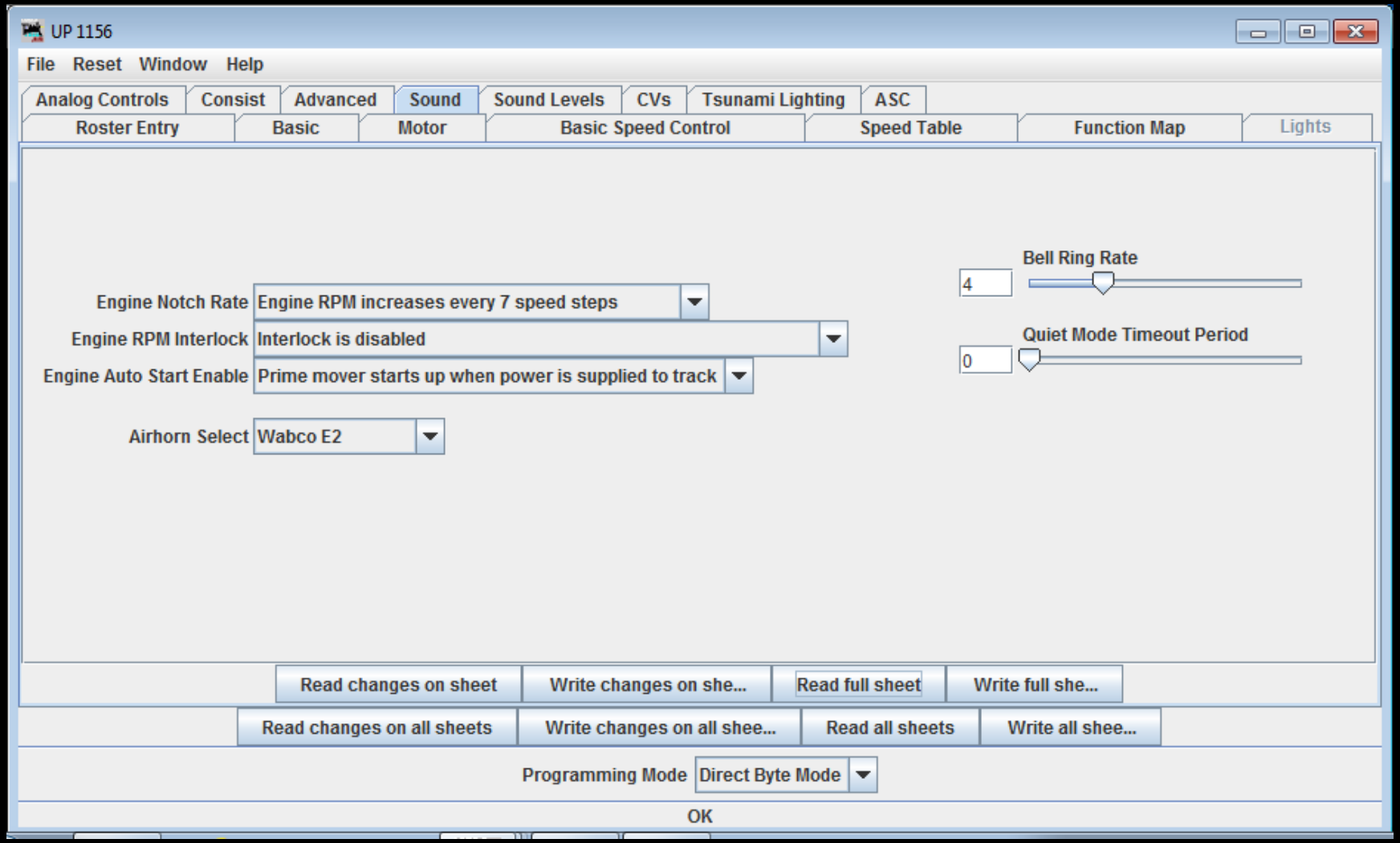
Manufacturer Specific CVs

- Over 100 CVs are reserved for manufacturer specific functions
- Need to consult the decoder documentation to know what CV values do what
- DecoderPro displays these as simple named options and valid selections, as it knows what kind of decoder is installed
- Biggest mess is with **Sound**

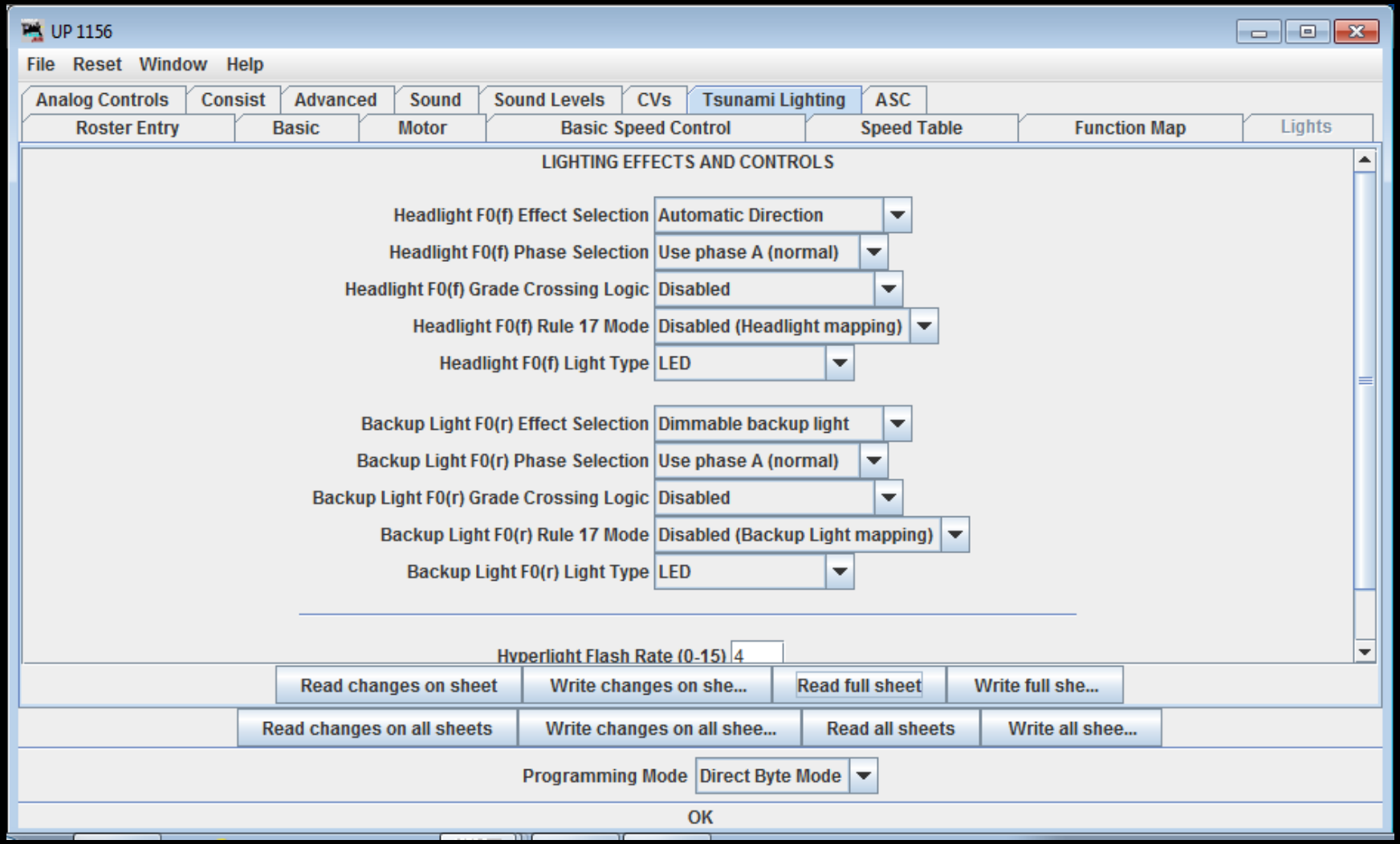
Sound CVs

- There are only 1024 direct CVs allowed
- Sound configurations need a LOT of CVs!
- Introduced the idea of **indexed** CV pages
- Gives a total of 61,440 indexed pages, each with 256 bytes of CV data available to manufacturers!
  - CV 31-32 is the base, CV 257-512 the data values
- Messy, **messy**, **MESSY**!

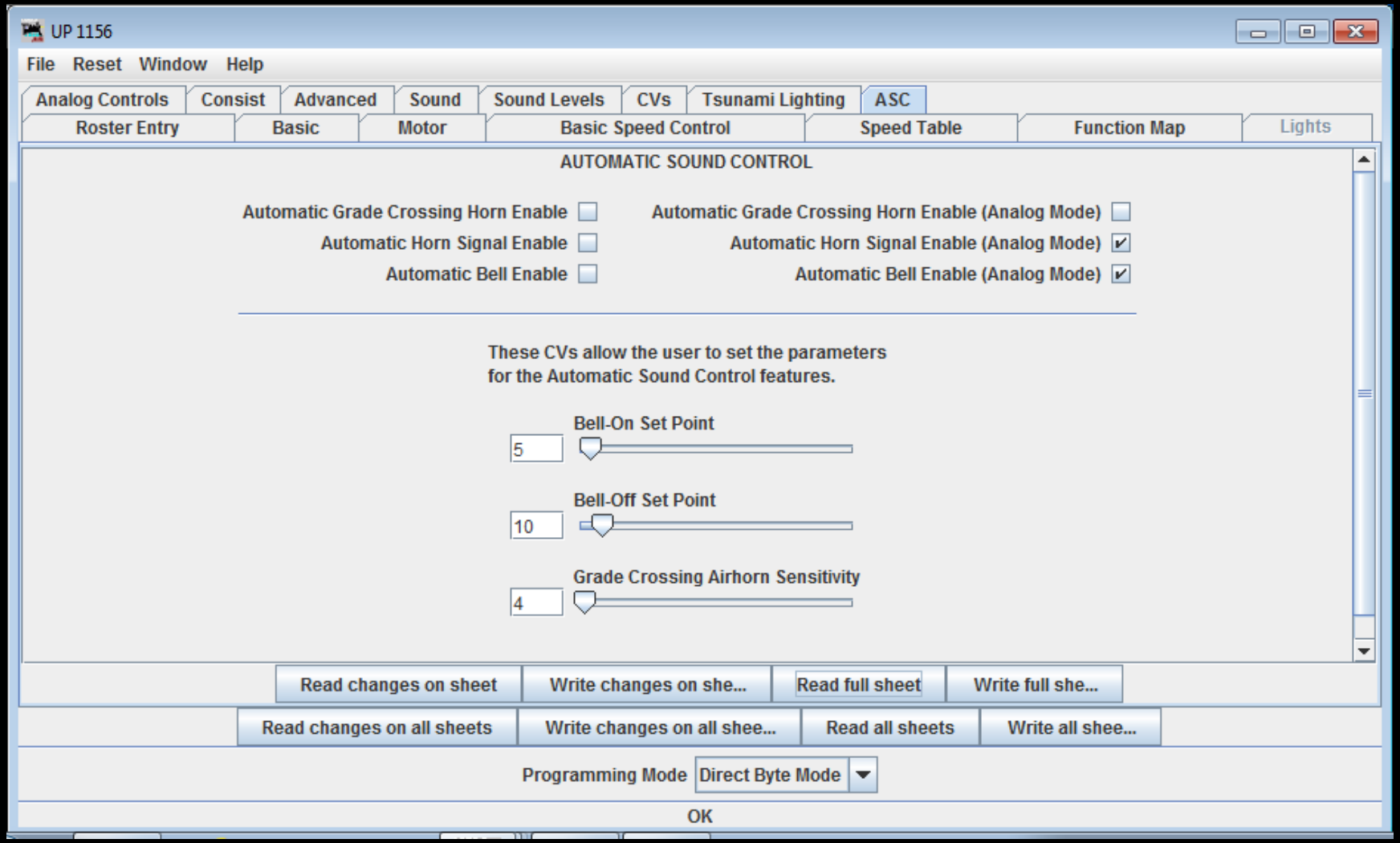
Sound in DecoderPro



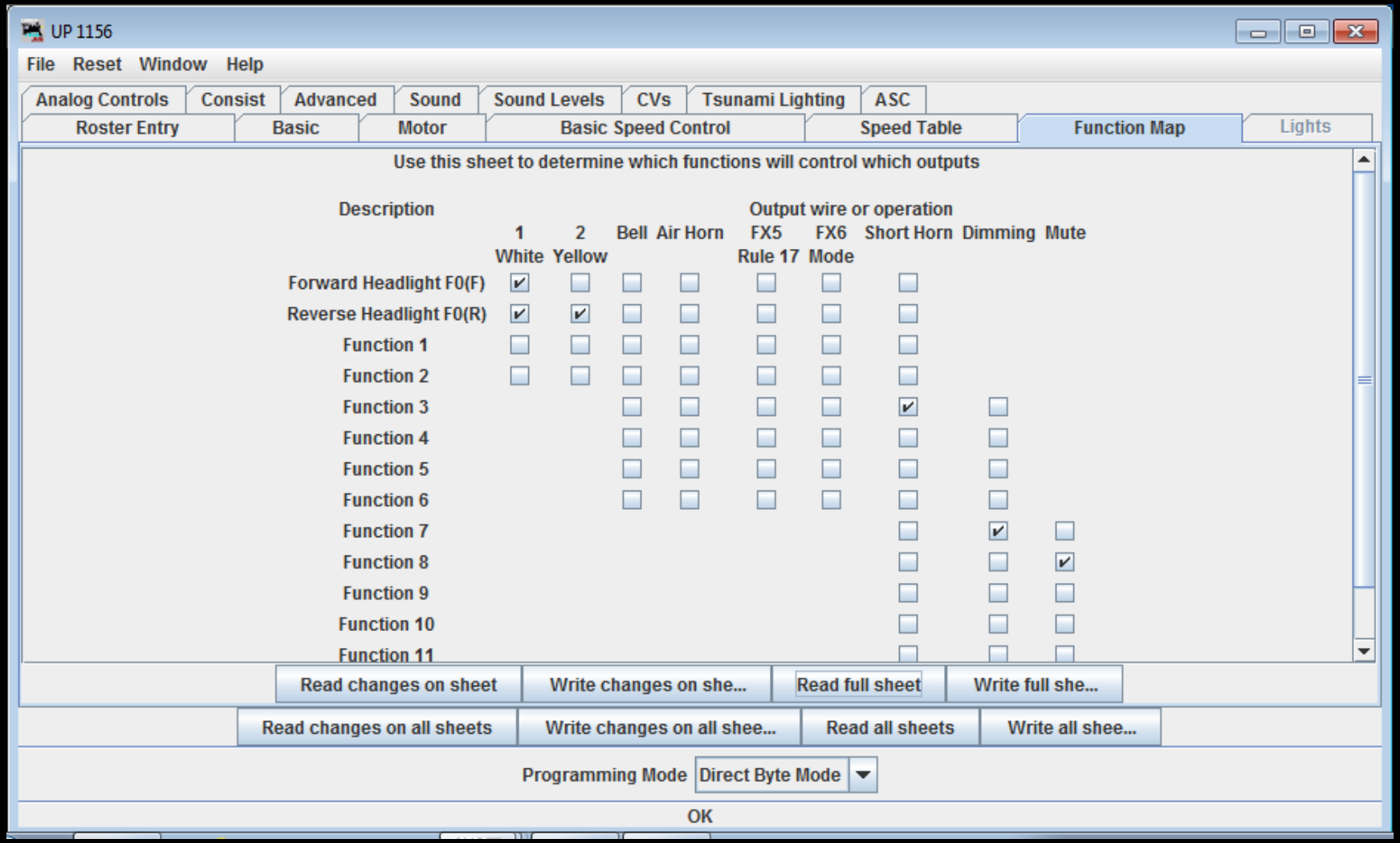
Tsunami Lighting Effects



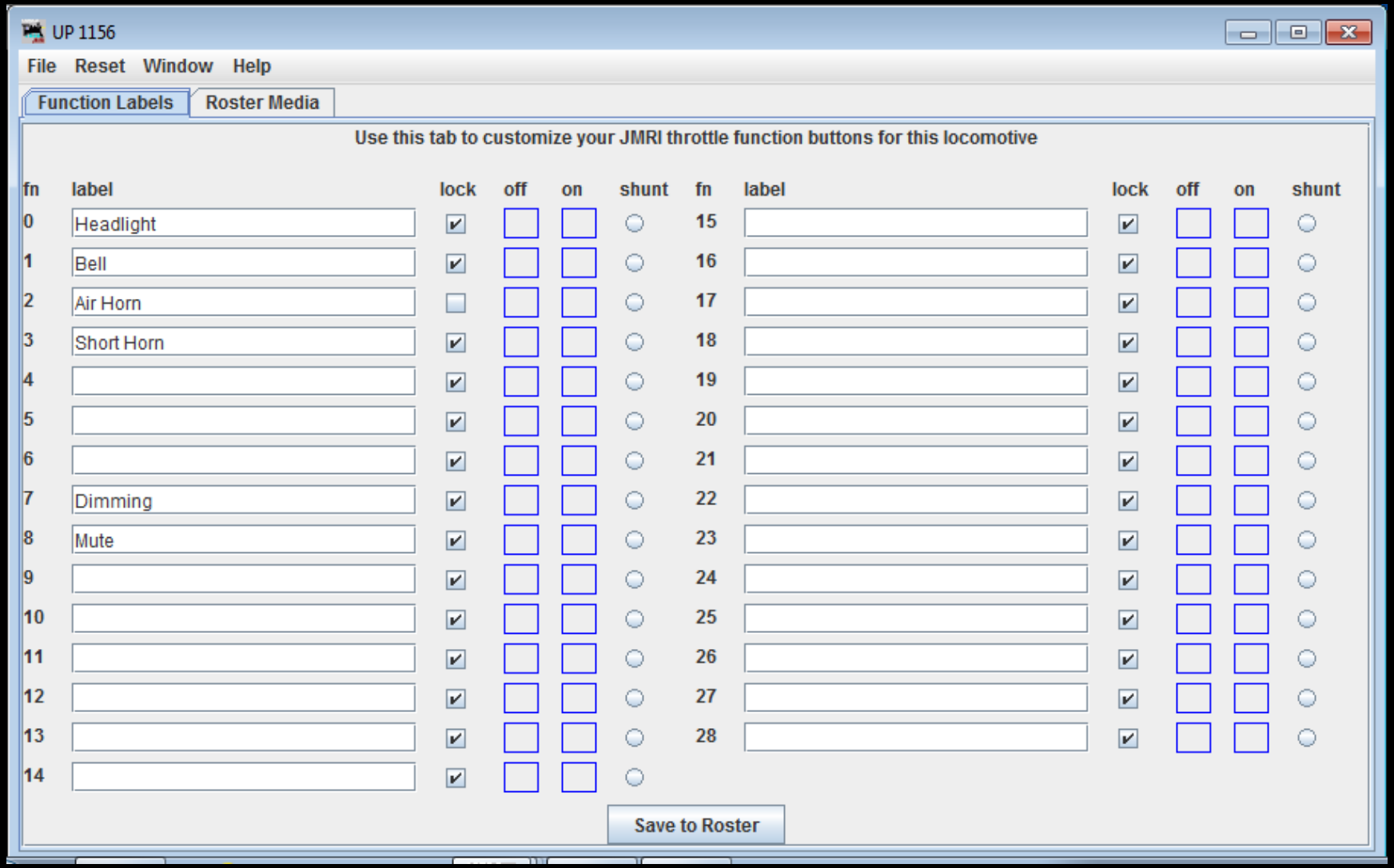
Automatic Sound Control



Function Mapping



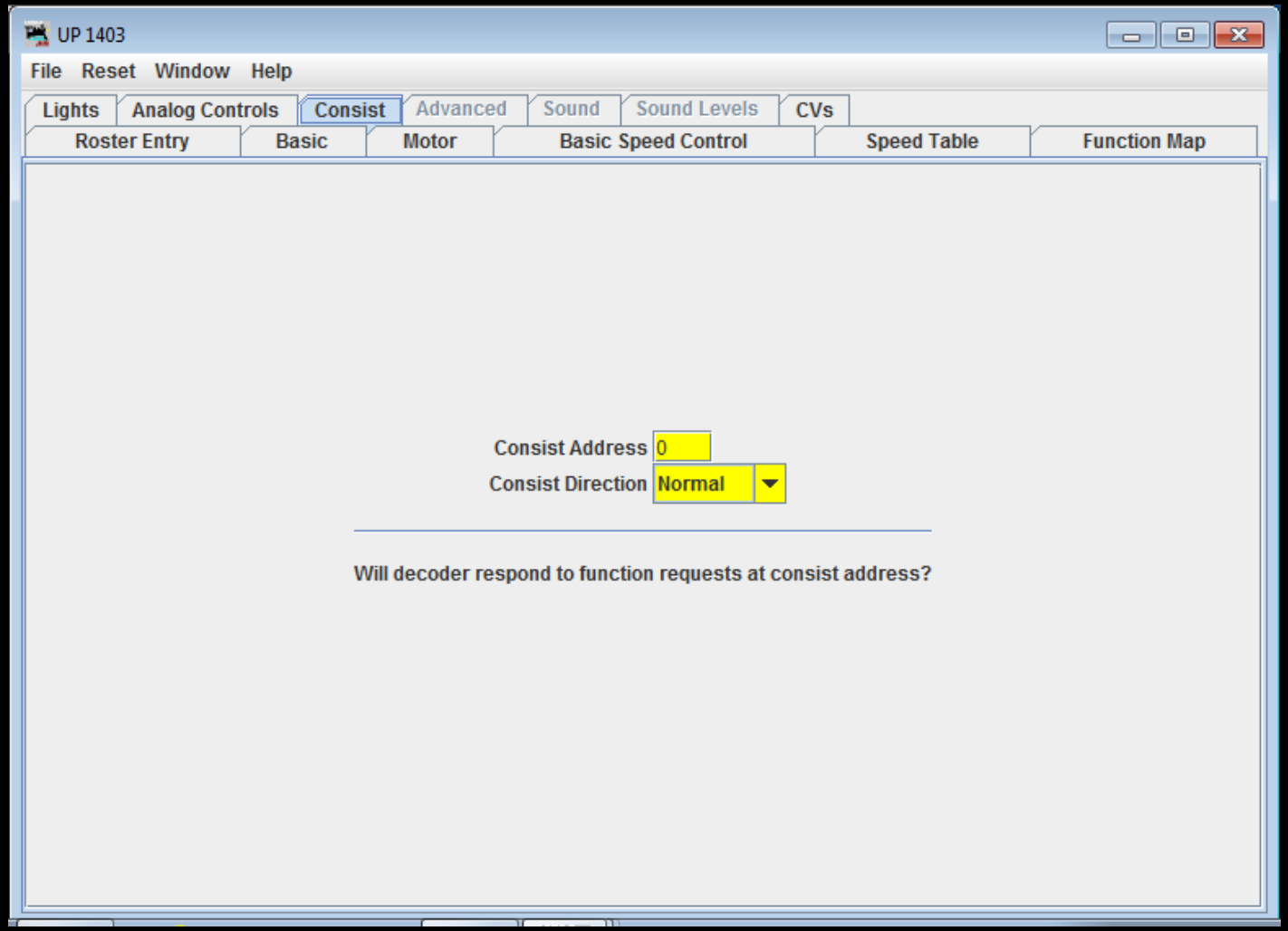
Function Labels



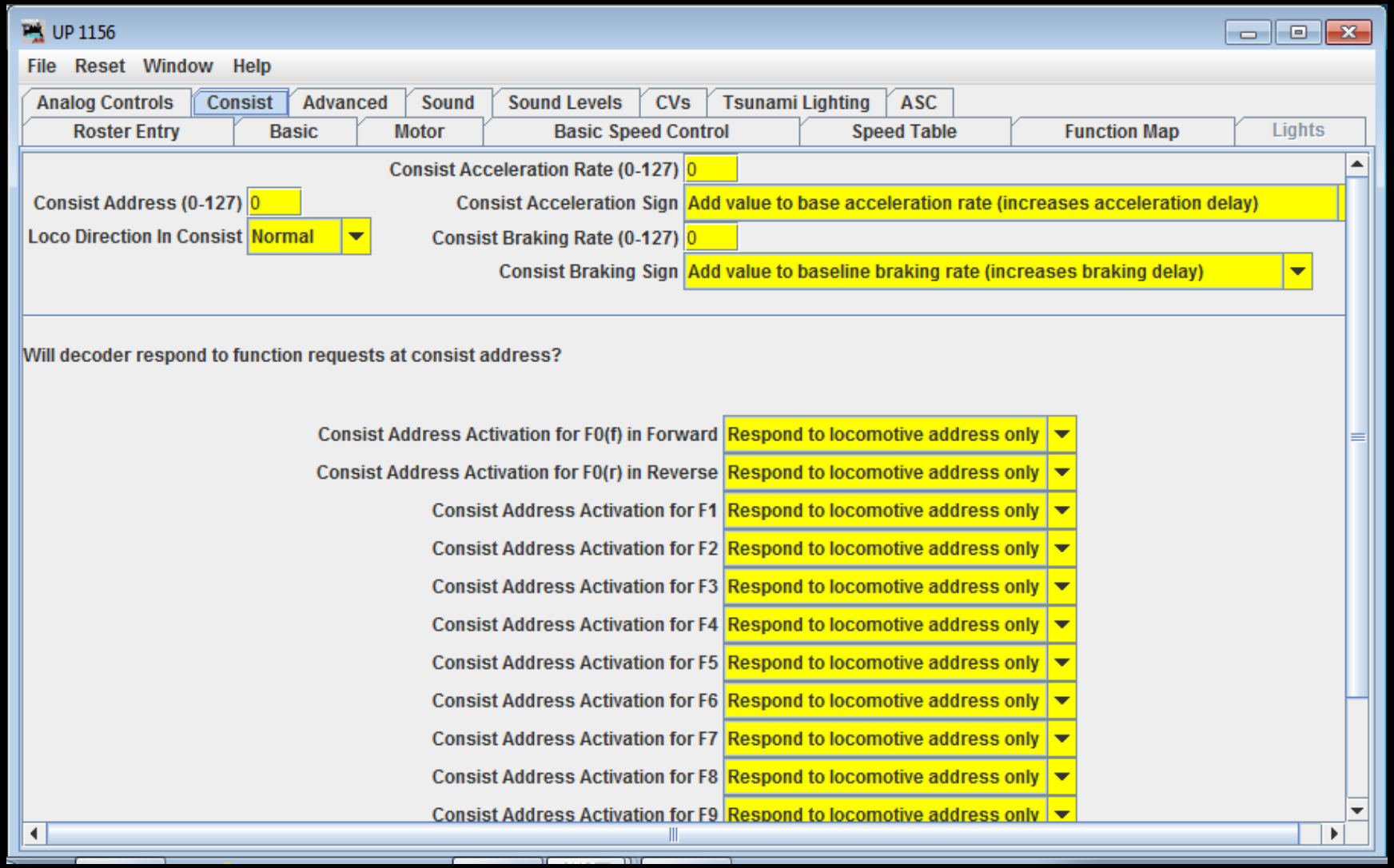
Decoder Assisted Consisting

- Uses CV 19 for a **Consist Address**
- If CV 19 is anything other than 0, decoder will respond to that address
- Can get tricky with sound decoders for things like the horn and bell
  - Which address should it respond to?
- Again, DecoderPro can help

Simple Decoder Consisting



Sound Decoder Consisting



Decoder XML Sample

- <variable CV="2" item="Vstart" default="10">
- <decVal max="31"/>
- <label>Start Volts</label>
- <label xml:lang="it">Volt Partenza</label>
- <label xml:lang="fr">V démarr.</label>
- <label xml:lang="de">Anfahrspannung</label>
- <comment>Range 0-31</comment>
- <comment xml:lang="it">Valori 0-31</comment>
- </variable>

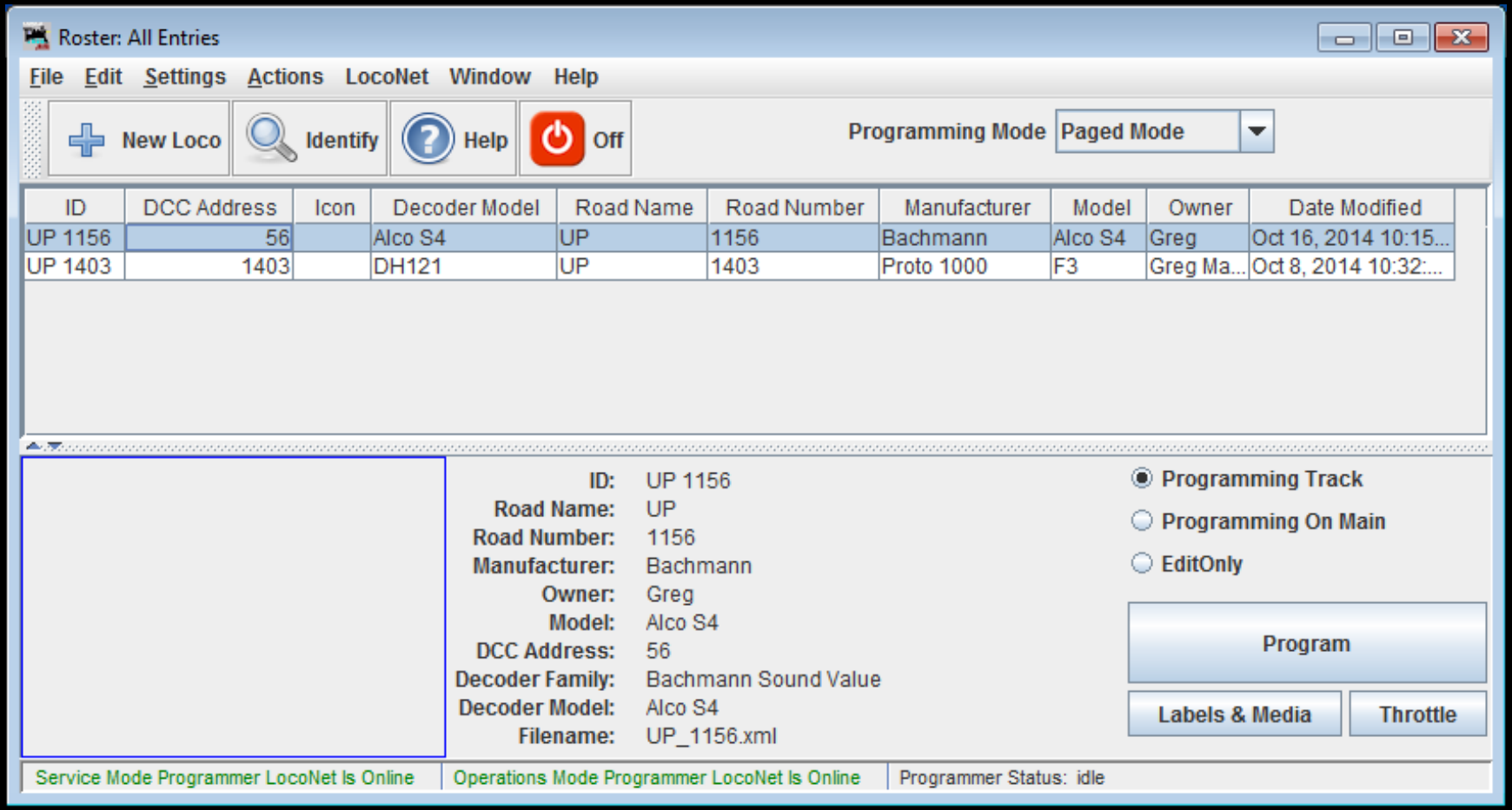
Address Overlap Issue

- Short addresses can be 1 – 127
- Long addresses can be 0 – 10,239
- What happened to 2 digit and 4 digits?
- Some systems limit short to 1 – 99 and long to 100 – 9999, others 1 – 127, 128 - 9999
  - Not consistent, so best to experiment
- Possible to have address 123 as either short or long, but expect problems

Other Benefits to DecoderPro

- All values stored in simple XML (text) files
  - One file per locomotive in a **Roster**
  - Think of it like a special spreadsheet file
- Easy to duplicate file for an exact copy
- Can easily restore all values to a decoder
- Easy to test different configurations
- Speed Table utility to help get shape right
- Function labels for smartphone throttles

Locomotive Roster



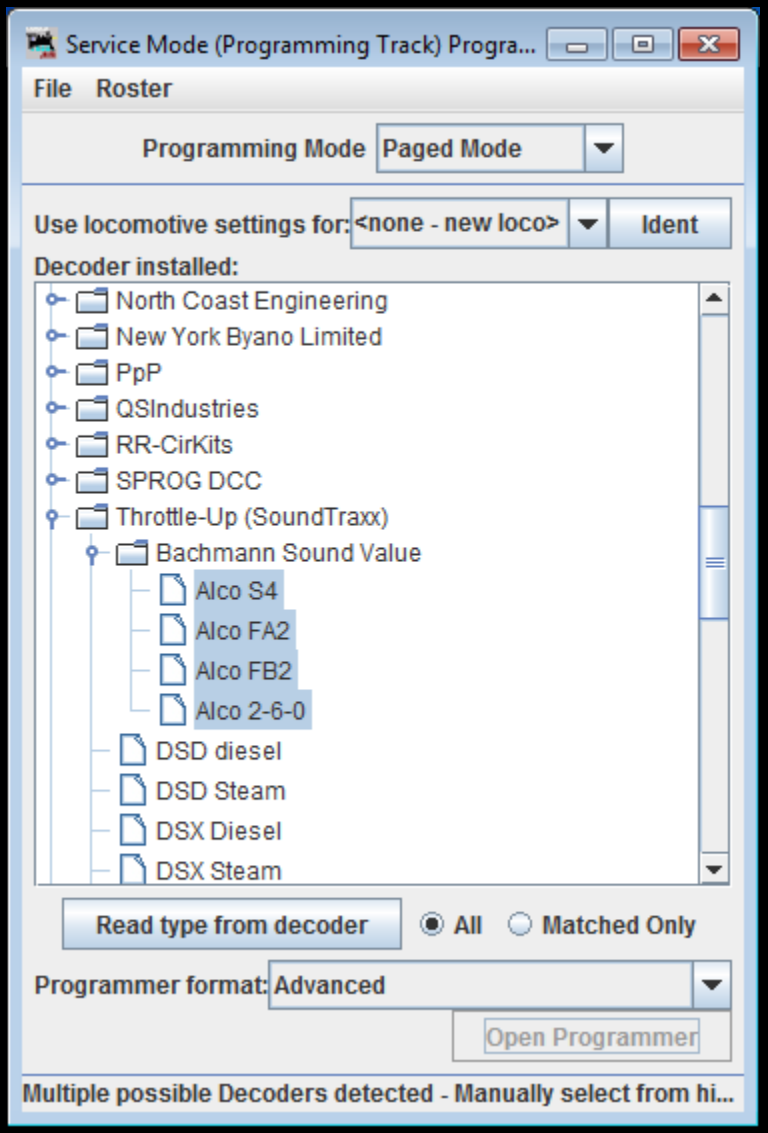
Roster XML Sample File

- <locomotive id="UP 1403" fileName="UP_1403.xml" roadNumber="1403" roadName="UP">
- <decoder model="DH121" family="Basic STD" comment="" />
- <locoaddress>
- <dcclocoaddress number="1403" longaddress="yes" />
- <number>1403</number>
- </locoaddress>
- <values>
- <decoderDef>
- <varValue item="Primary Address" value="3" />
- <varValue item="Extended Address" value="1403" />
- <varValue item="Address Format" value="1" />
- <varValue item="Start Volts" value="0" />
- <varValue item="Version ID" value="34" />
- <varValue item="Manufacturer ID" value="129" />
- <varValue item="Kick Start" value="0" />
- …
- </decoderDef>

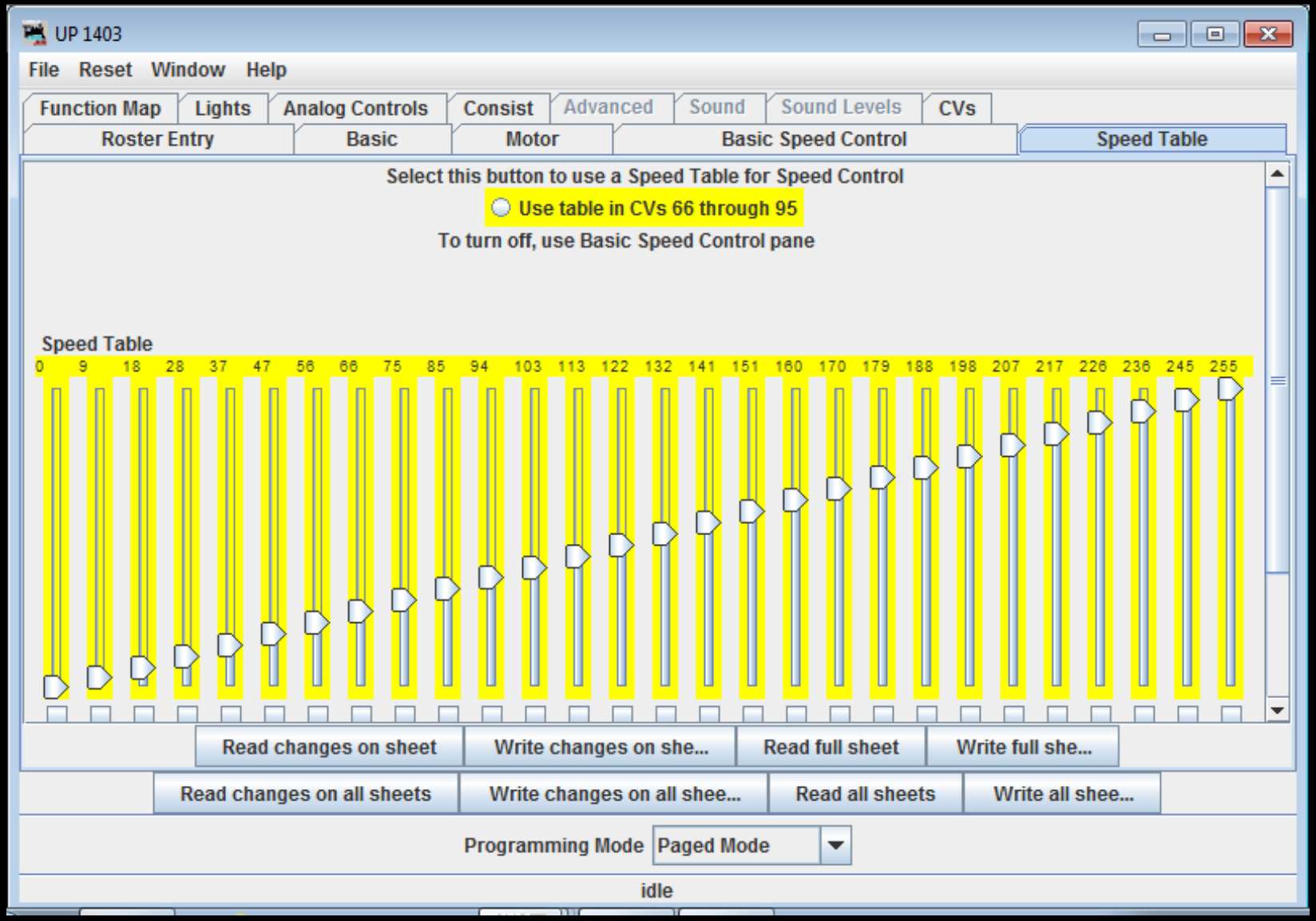
Roster XML Sample File (cont'd)

```
        <CVvalue name="1" value="3" />
        <CVvalue name="2" value="0" />
        <CVvalue name="3" value="0" />
        <CVvalue name="4" value="0" />
        <CVvalue name="5" value="0" />
        <CVvalue name="6" value="0" />
        <CVvalue name="7" value="34" />
        <CVvalue name="8" value="129" />
        <CVvalue name="17" value="197" />          (Extended address
        <CVvalue name="18" value="123" />           for 1403)
        …
      </values>
    </locomotive>
  </locomotive-config>
```

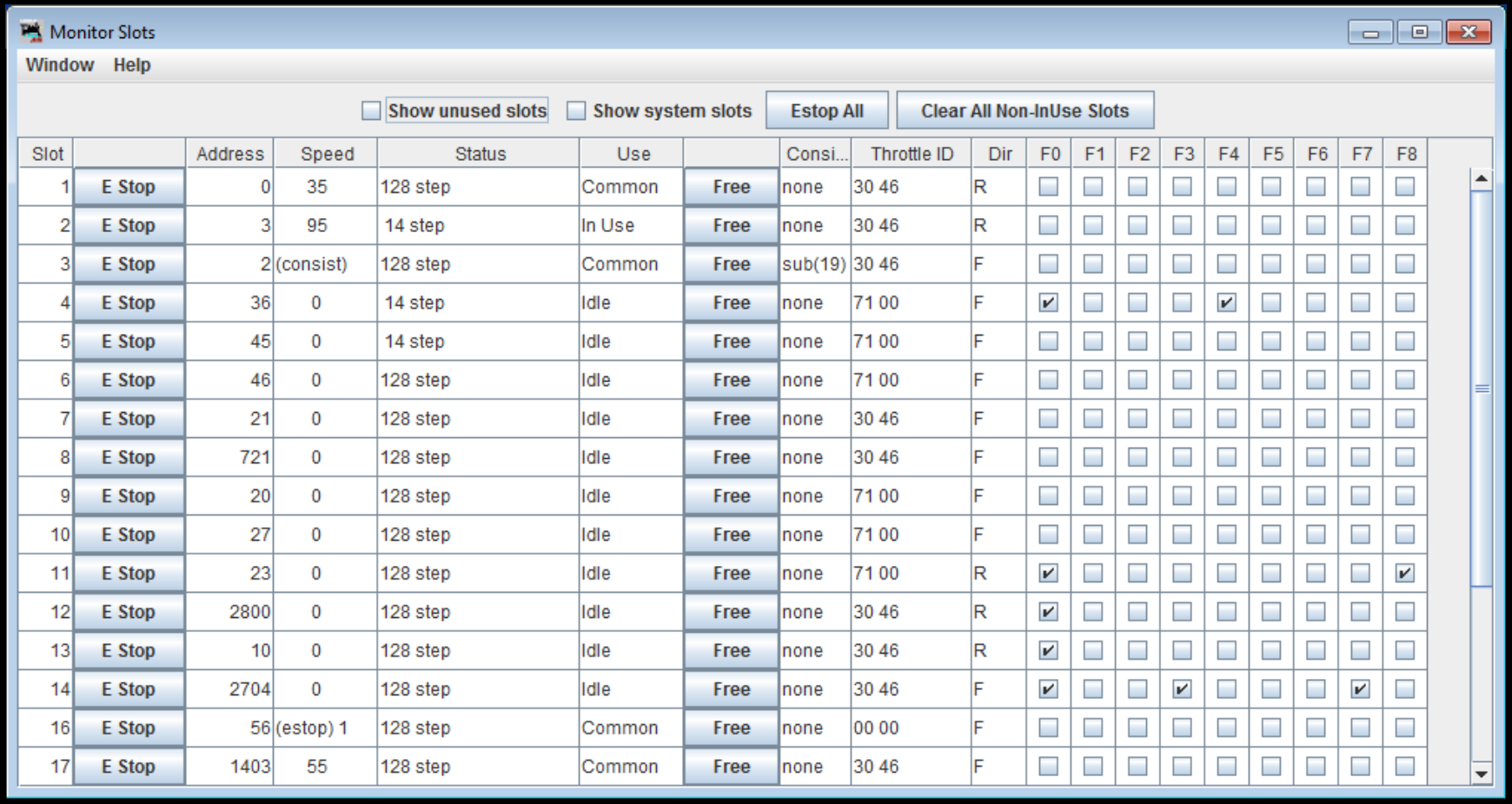
Help Determine Decoder Type



Speed Tables

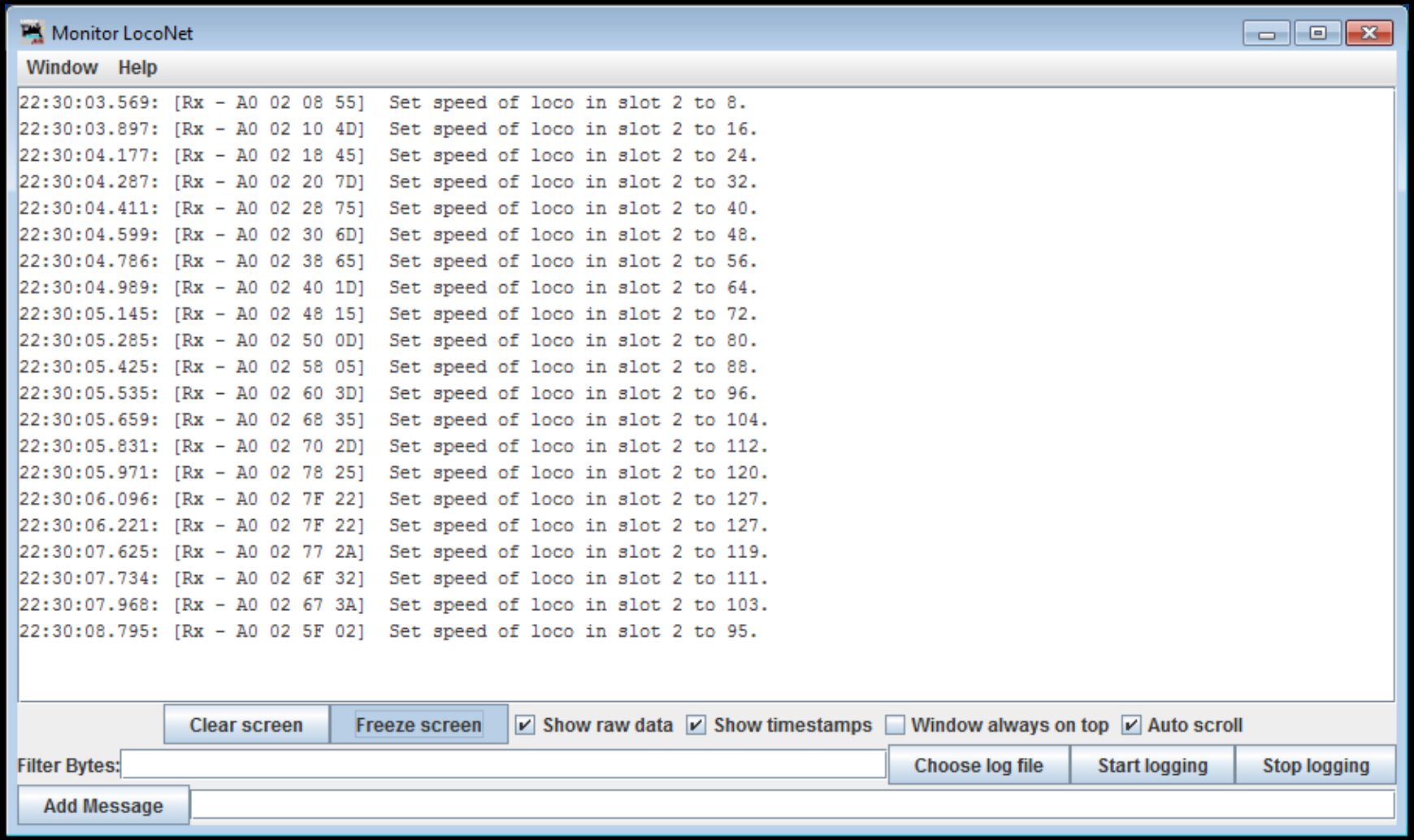


Monitor Throttle Slots on Digitrax



Slot		Address	Speed	Status	Use		Consi...	Throttle ID	Dir	F0	F1	F2	F3	F4	F5	F6	F7	F8
1	E Stop	0	35	128 step	Common	Free	none	30 46	R	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	E Stop	3	95	14 step	In Use	Free	none	30 46	R	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	E Stop	2	(consist)	128 step	Common	Free	sub(19)	30 46	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	E Stop	36	0	14 step	Idle	Free	none	71 00	F	☑	☐	☐	☐	☑	☐	☐	☐	☐
5	E Stop	45	0	14 step	Idle	Free	none	71 00	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	E Stop	46	0	128 step	Idle	Free	none	71 00	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
7	E Stop	21	0	128 step	Idle	Free	none	30 46	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
8	E Stop	721	0	128 step	Idle	Free	none	30 46	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
9	E Stop	20	0	128 step	Idle	Free	none	71 00	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	E Stop	27	0	128 step	Idle	Free	none	71 00	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
11	E Stop	23	0	128 step	Idle	Free	none	71 00	R	☑	☐	☐	☐	☐	☐	☐	☐	☑
12	E Stop	2800	0	128 step	Idle	Free	none	30 46	R	☑	☐	☐	☐	☐	☐	☐	☐	☐
13	E Stop	10	0	128 step	Idle	Free	none	30 46	R	☑	☐	☐	☐	☐	☐	☐	☐	☐
14	E Stop	2704	0	128 step	Idle	Free	none	30 46	F	☑	☐	☐	☑	☐	☐	☐	☑	☐
16	E Stop	56	(estop) 1	128 step	Common	Free	none	00 00	F	☐	☐	☐	☐	☐	☐	☐	☐	☐
17	E Stop	1403	55	128 step	Common	Free	none	30 46	F	☐	☐	☐	☐	☐	☐	☐	☐	☐

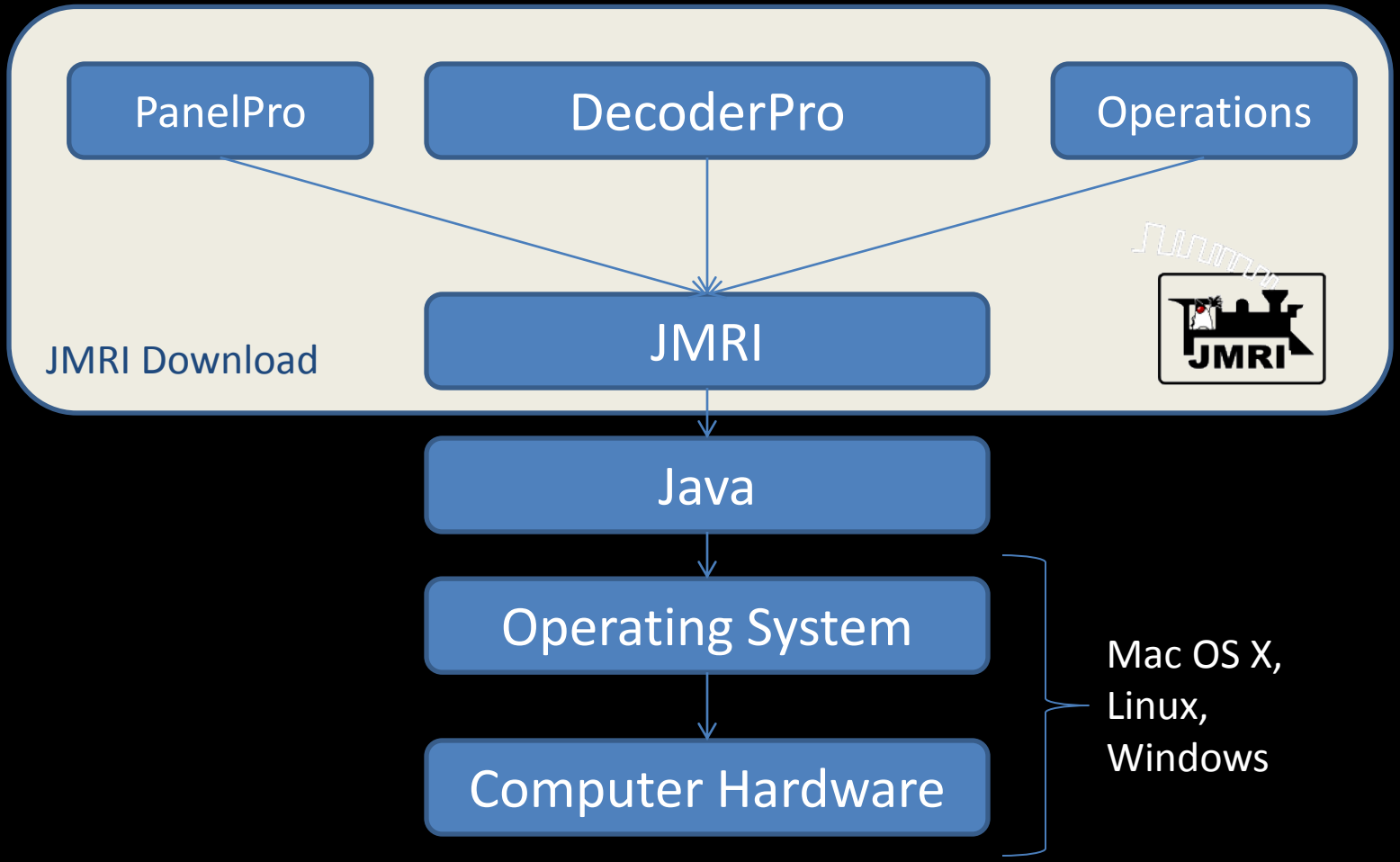
Monitor LocoNet on Digitrax



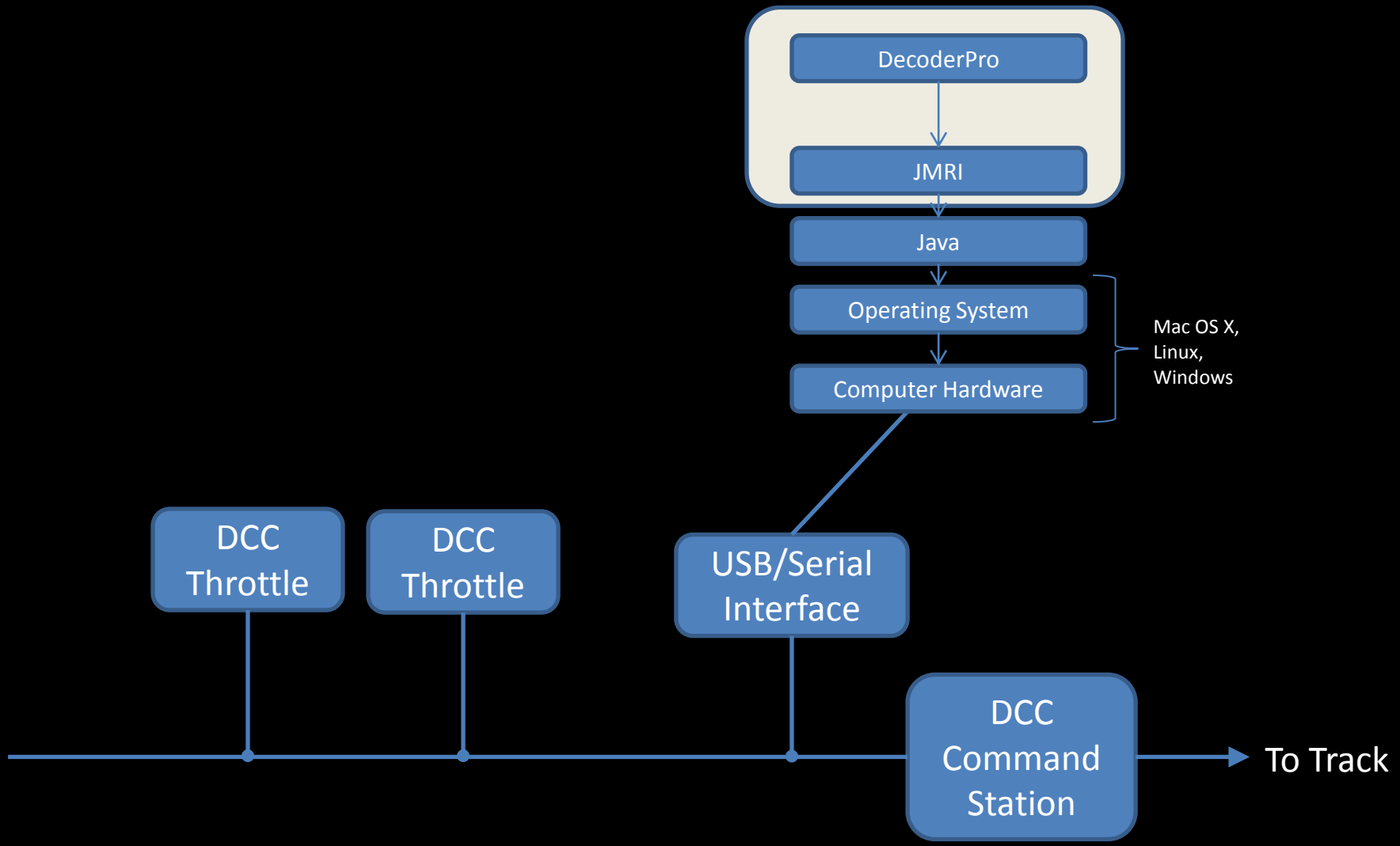
So, What do you need?

- **DecoderPro**, part of the Java Model Railroad Interface project (JMRI)
- **Java** platform for Mac OS X, Linux or Windows
  - JMRI and Java are free downloads
- An hardware **interface device** between your computer and DCC system
  - I use a LocoBuffer-USB for Digitrax

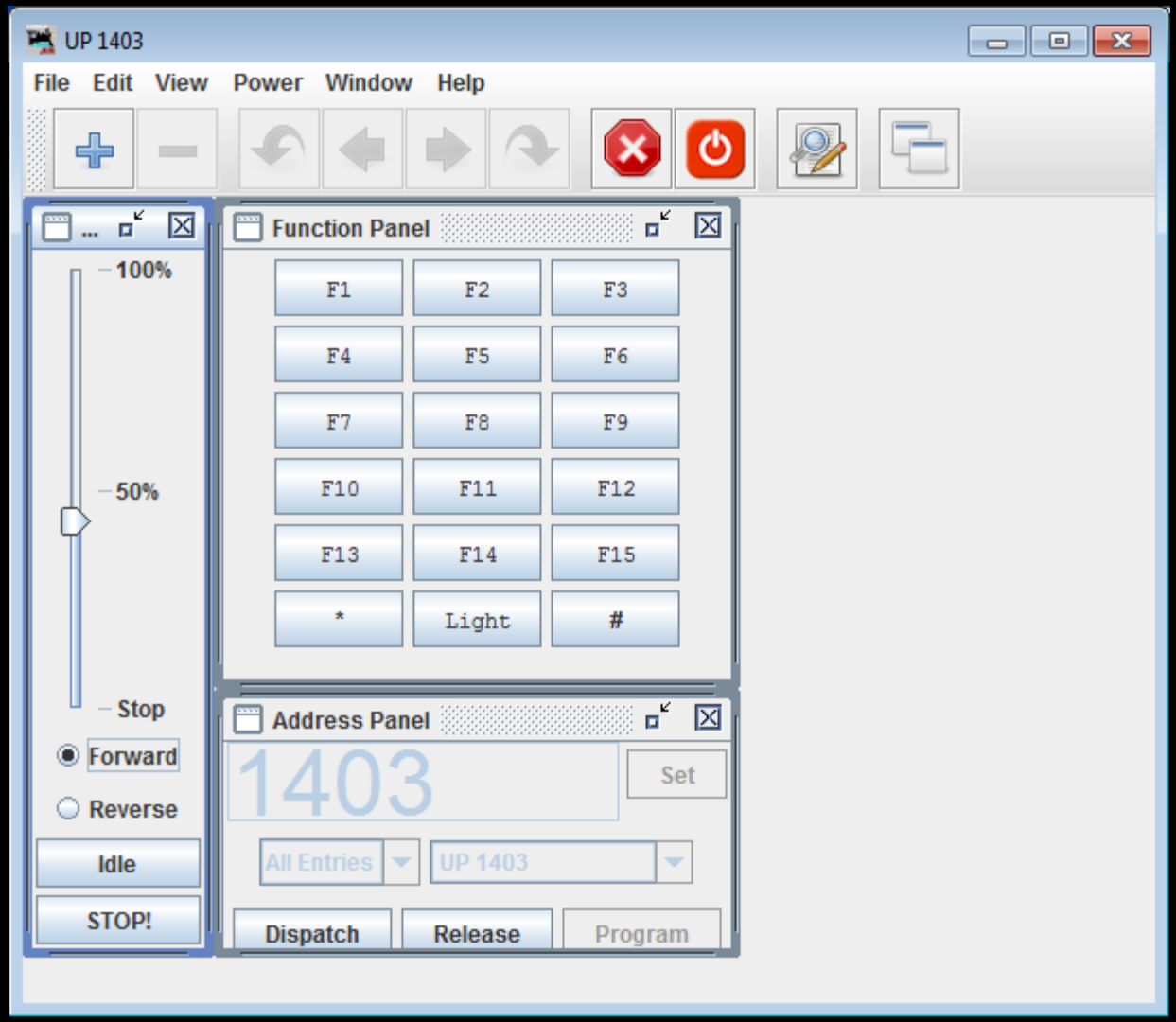
DecoderPro, JMRI, and Java



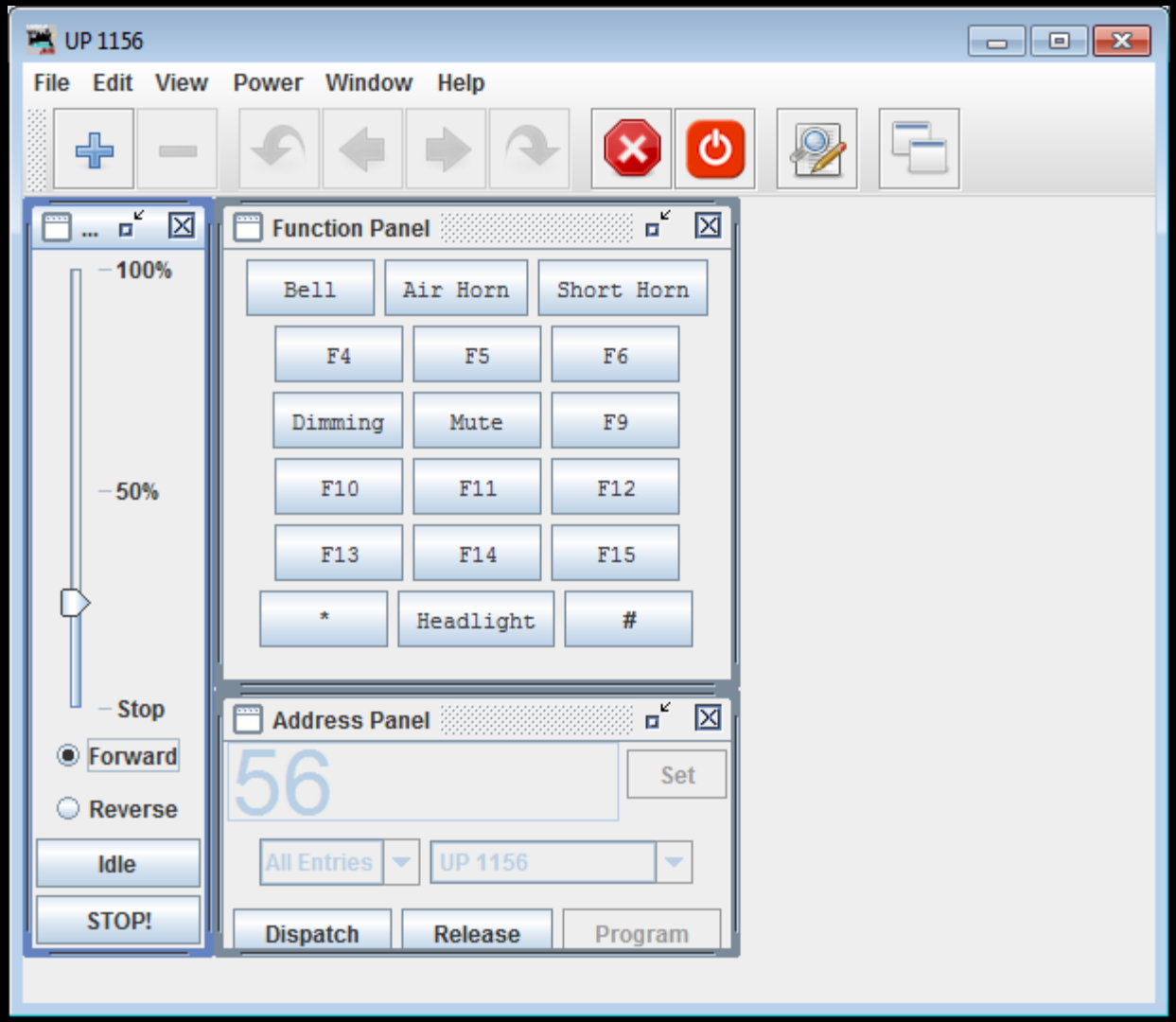
JMRI Connected as a Throttle



Simple Decoder Throttle



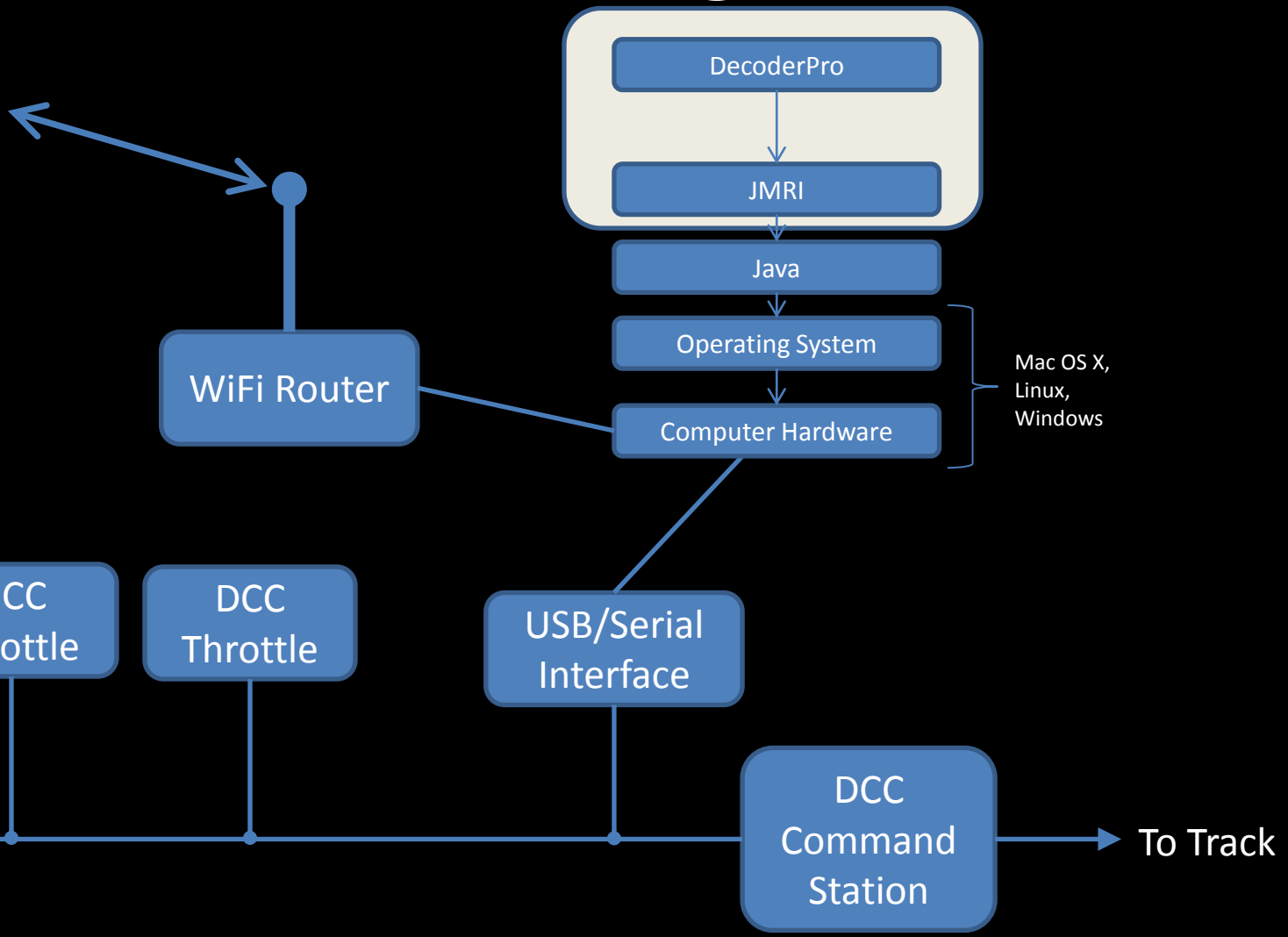
Sound Decoder Throttle



WiThrottle

- Use your Apple or Android smartphone as a wireless throttle
  - **WiThrottle** for iOS
  - **EngineDriver** for Android
- Talks over WiFi to a service running in DecoderPro
- Just another throttle
- WiFi wireless seems to be more reliable than Digitrax radios

WiThrottle Diagram



It’s Just a Throttle

- Remember this!
  - DecoderPro **cannot** do anything beyond what your existing DCC system can do, as it uses the *same command station* to do everything

Links

- NMRA DCC standards: nmra.org
- JMRI: jmri.org
- Java: java.com
- WiThrottle: www.withrottle.com
- Engine Driver: enginedriver.rrclubs.org
- LocoBuffer-USB: www.rr-cirkits.com