Signaling a Modular Layout

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& the HUB Division Signal Committee
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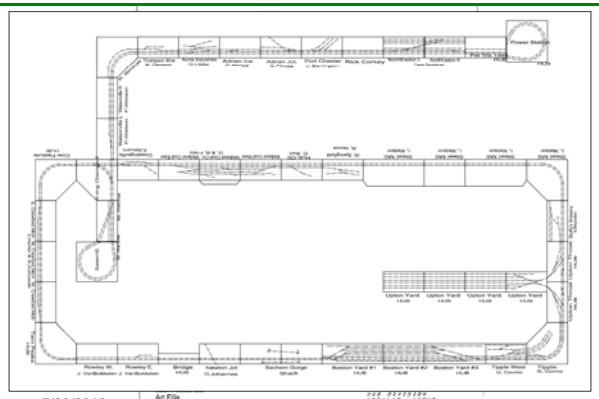
The HUB Division Signal Committee Members

About the HUB Division

- A Division of the NER
- 54 years old
- Approximately 400 members
- Almost all of Massachusetts
- Excellent website: www.hubdiv.org
- Modular Railroad began in 1989

Humble Beginings



Hoosac, Upton & Boston RR

- Now over 65 members
- David Haralambou is the current Co-ordinator
- Very large setups including the annual Amherst Railway Society Show & our New England Model Train Expo
- Annual displays at Children's Hospital Boston the National Heritage Museum
- Shown internationally: Canada, Germany, Netherlands
- Very early adopter of DCC (after all, Stan and Debbie Ames are members) Has always been Lenz driven
- 1st Place awards at NMRA Nationals both in individual modules and modular railroad categories.

You can learn a lot in 8 sq ft

- 5 bus wiring harness supports 2 mainlines buses, a third track bus, accessory DCC bus and an 18 volt AC accessory bus
- 2 Cat5 buses: XpressNet & signaling
- Replete with high-end craftsman structures and scratch-built structures
- Numerous experiments with scenic techniques
- Remember, the overarching goal is to serve our members
- Why not Signaling next??

Goals & Rationale

- Increase the knowledge and curiosity in signaling within HUB Division members
- Add a new level of operating interest to the modular layout
- Enhance the viewing experience for spectators of the layout
- Sounded like fun!!

Approach (R^3C^3)

- Research, research, research
  - Reading
  - NMRA Convention Visits
  - Formed a Signaling Committee
  - Created a Requirements Specification
- Communicate, communicate, communicate
  - Spring Training
  - RailFun
  - The Headlight
  - Get a master involved (Dr. Bruce Chubb)

The Difficult Requirements

- Modular specification forbids circuitry in-line with the DCC signal
- Minimal (if any) changes to existing modules if the builder choose not to add signals
- Cost
- Railroad can operate even if the signals don't
- Must be able to shuffle modules in any order at each setup and signaling must work with no wiring changes and minimal setup effort

Advice we had been given

- Pay attention to modeling details just as you would in any other aspect of model railroading
- Separate the signaling bus from train control
- You won't regret using either C/MRI or Digitrax
- Largely, we took this advice but made some compromises

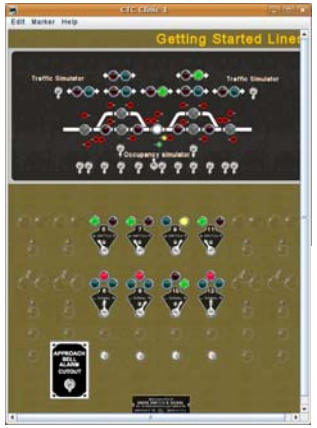
Frame the Issues

- This is a classical data processing issue
  1. What are the inputs and where do they come from?
  2. How do we process the incoming data transforming it into information?
  3. How do we output the processed information?
- We were looking for a hardware *AND* a software solution

Experiment, Experiment, Experiment

- We adopted JMRI early
  - Broad support for multivendor solutions
  - Already had experience with DecoderPro & WiThrottle
  - We got to the point where we could build US&S style panel using PanelPro.
    - JMRI website
    - Dick Bronson's NMRA online clinics

Controlling the System



Screen shot from Dick Bronson's Hartford National Clinics

But there was interest in a modern CRT based panel

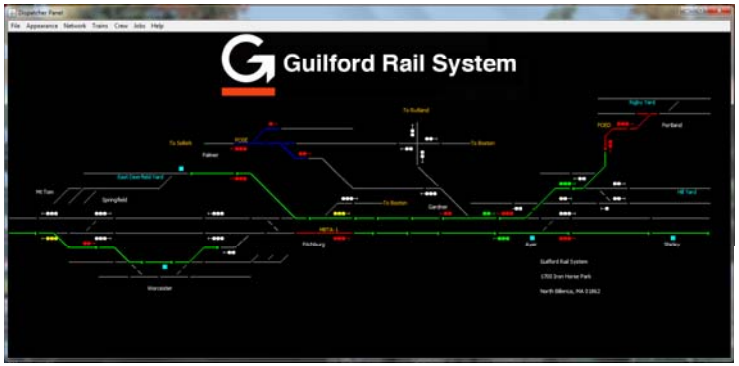
- We looked at the Layout Editor
- Through the JMRI Website, we discovered CATS
- Open Source JAVA software layered atop PanelPro
- Written by Rodney Black. Like JMRI, it has an online user forum
- Based upon prototype Digicon system

Direct Comparison

Screenshot of the Digicon Prototype

CATS Rendering of the Prototype

CATS Screen Shot



CATS Demo

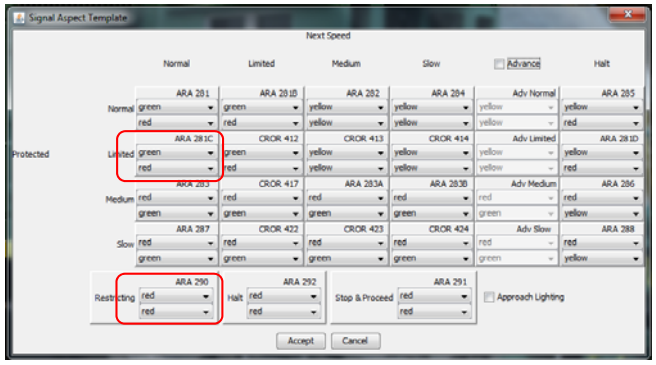
CATS

- Several outstanding features
  - Uses all the debugging tools in JMRI
  - Signaling based on 4 track speed / 2 block rules
  - Great benefits even without signals
  - “Pre-programmed” signal logic
  - Well written online manuals
- Three program suite
  1. Designer (development environment)
  2. CATS (runtime environment)
  3. Trainstat (realtime layout status)

Designer

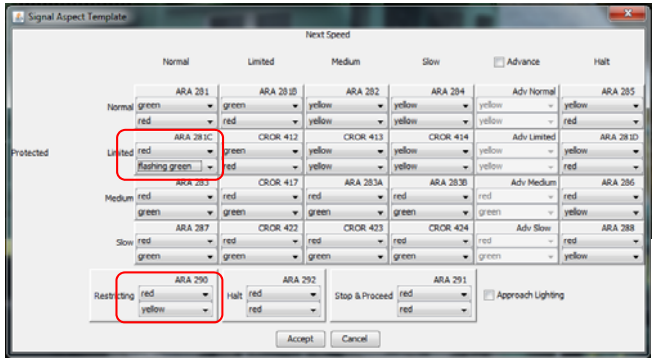
- Tool used to define
  - Tracks (4 speeds & signal discipline)
  - Signal Templates
  - Signal Locations
  - Sensors
  - Turnouts (turnouts and signalheads)
  - Lights
  - Appearance (pictures and stations)

The Signal Template



Define your signal rules

The Signal Template



Designer Demo

Arbitrary Module Order

- How does one swap module order and preserve signal logic?
- The File → Import function

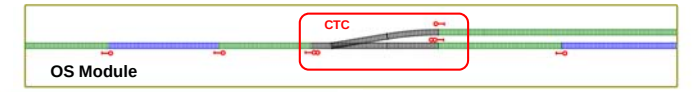
- File->Import reads in a saved layout (a library) without erasing any existing work. It is a way to merge multiple layouts together, add some pre-canned design elements to the existing layout, insert existing signal definitions, etc. When a file is selected, designer will grab the track plan from the file and insert the upper grid corner of the trackplan at the grid cursor location. It will expand the layout in the horizontal and vertical directions as needed. Note that the library is not inserted, but replaces existing track; thus, preserving any track not overlaid
- Tracks, information associated with tracks (e.g. Block definitions), Stations, Signals, etc. will be added to the existing work. File->Import will also merge any Devices (Section 8) defined in the file, but not any Appearances (Section 14.1), Trains (Section 10), Crew (Section 12), or Jobs (Section 11). "Merging" is defined as "if something in the file does not exist in the current trackplan, it is added". This means that things in the library file will not replace things with the same name in the trackplan.

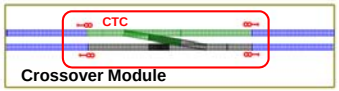
We built 5 "test" modules

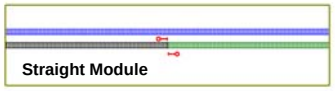
- Three were "active" modules (e.g. have a signaling card)
  - These 3 contained signals
  - Each module used a different type of signal
    - 1 used G-type, 1 used Searchlight, 1 used D-type
    - All wired as common anode
  - NCE AIU & DB20s used for detection, Oaktree signal boards
- Two were "passive" (e.g. do not have a signaling card)
  - No detection
  - No signals
  - These represent unchanged modules
- Wiring strategy:
  - Inner main supplies power & detection to the left
  - Outer main supplies power & detection to the right

The Test Modules

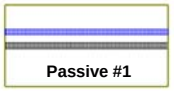
Three "Active Modules

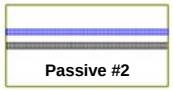






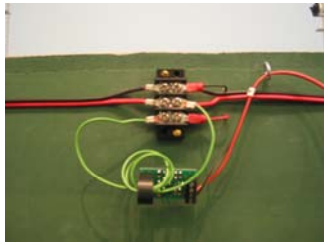
Two "Passive" Modules



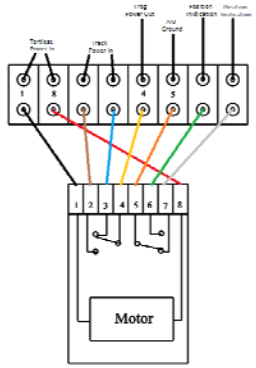


The "Active" Modules

BD20 Wiring



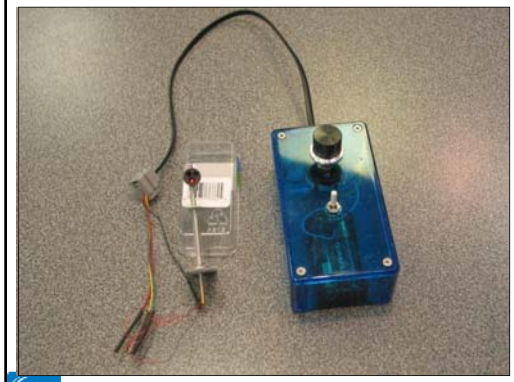
Turnout Motor Connections

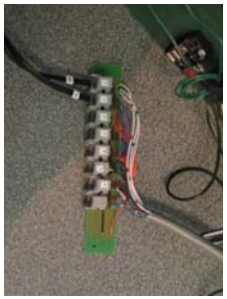


Tortiose Switch Machine

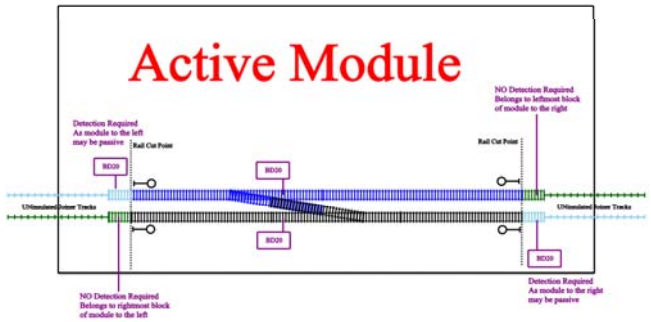
Signals in 90 Minutes

Connections

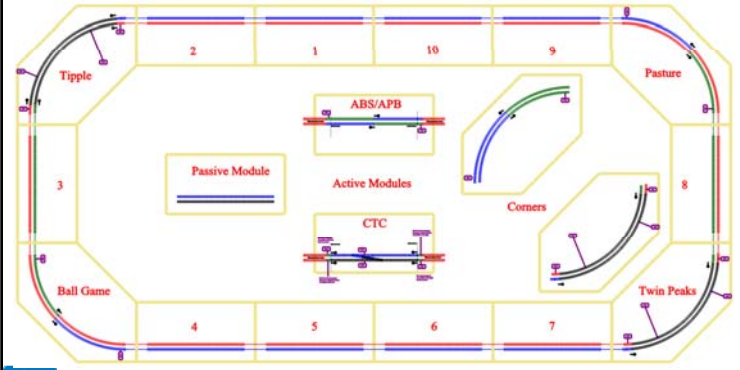




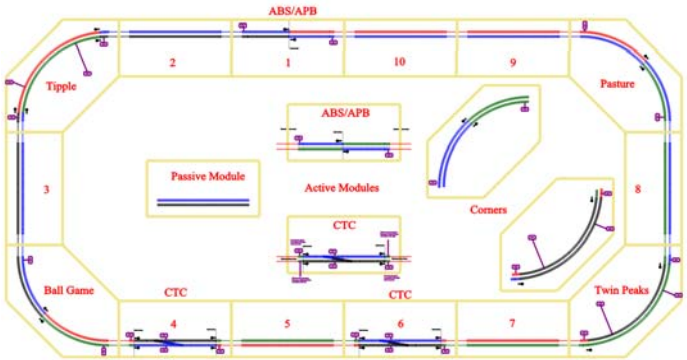
Wiring scheme



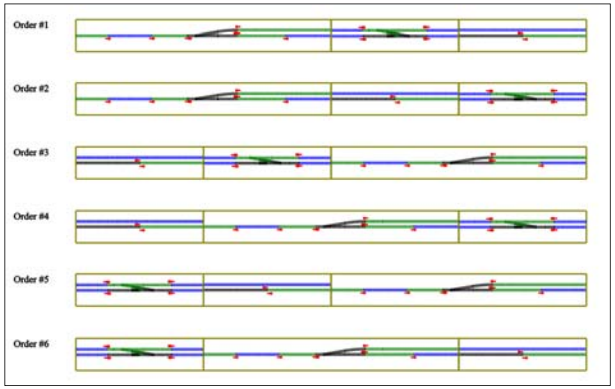
Simple Oval



Splicing in Active Modules



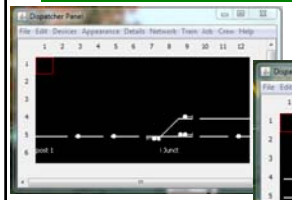
The Permutations



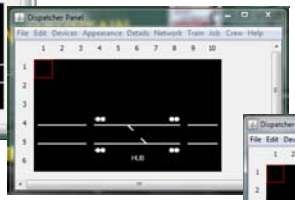
Hardware Evaluation Table

Manufacturer	Strengths	Reason for Elimination
C/MRI	**Passed all tests**	
Oaktree Systems	Reasonable price. Lots of positive testing results	Minor failure on turnout positioning. No simulator
Digitrax	Full hardware support	Signal board does not fully support all 3 color blinking aspects.
CTI Acela	Very modular, relatively low cost	Self recognizing network redefines addresses with module rearrangement. No simulator
ProTrack Grapevine	Very Modular	Possible issues with detection method. No simulator
Custom Signals	Manufactures signals as well as boards. Source for the Atlas system	Does not support JMRI. Fails a major requirement
Signals by Spreadsheet	Very clever combination of hardware and software for signaling	Does not support JMRI. Fails a major requirement
Integrated Signal Systems	Long time Manufacturer of high end signals	Does not support JMRI. Fails a major requirement

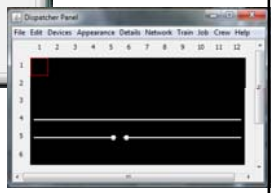
The Designer Files



OS Module

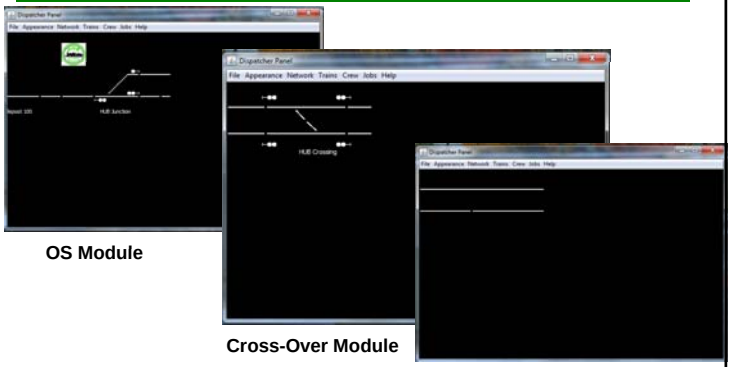


Cross-Over Module



Straight Module

CATS Runtime



OS Module

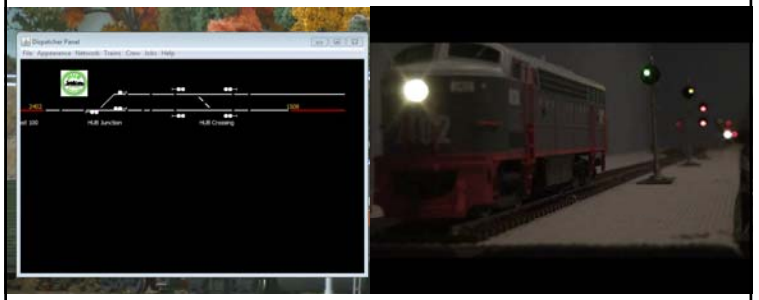
Cross-Over Module

Straight Module

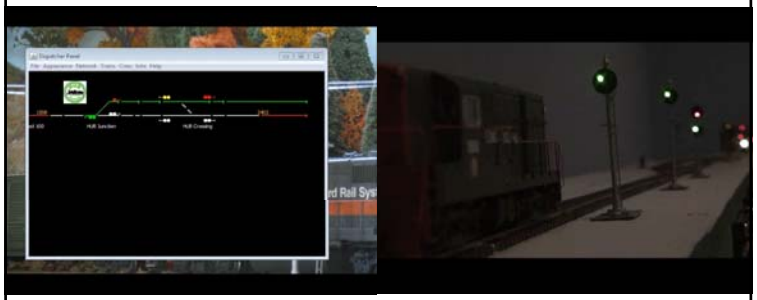
"INSERTION" Demo

Runtime 3 Module Section

The Rolling Meet



The Anxious Dispatcher



Summary

- Signaling on modular layouts can be done without constraining either the sequence of modules or limiting the function of the signaling system
- Can run with or without a dispatcher
- Didn't want perfection to become the enemy of the good
- Lenz LAN-USB connection, BD20 detectors, C/MRI boards, JMRI & CATS software

THANK YOU!