Signaling a Modular Layout

Dick Johannes
& the HUB Division Signal Committee
July 2014
The HUB Division
Signal Committee Members
Humble Beginnings

Initial Participants
Larry Madson
Mike Marsh
Walter Warriner
Peter Watson
Ken Belovarac
Jack Alexander
Art Ellis
Jim Lipper
Don Howd
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 in Lexington, MA
- 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

- At the outset we had:
  - 5 bus wiring harness supports 2 mainlines buses, a local track bus, an accessory DCC bus, and an 18 volt AC accessory bus
  - 2 Cat5 buses: XpressNet bus & a 2nd unused Cat5 bus
- 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??
The $R^3C^3$ Approach

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

- 1840: Ball signals: LTC Rolt
- 1841: Semaphore – Charles Gregory
- 1851: Telegraph – Chas Minot
- 1870: Track Circuit – William Robinson
- 1871: Disk (Banjo) Signal – Thomas Hall
- 1904: Color light signals – William Churchill
- 1915: Position-light signals – Arthur Rudd
- 1924: Color Position signals – Frank Patenall
- 1925: Tri-color (G type) signals - GRS
Two types of “regions”

Interlockings (Junctions & Sidings)

Linear Blocks
The Distinctions

• Linear blocks
  – **Unsupervised** (e.g. totally automated)
  – Default is “clear” or “green”
  – ABS (Automatic Block Signaling)
  – APB (Absolute Permissive Block)

• Interlockings (Junctions & Sidings)
  – **Human operated** (e.g. human controlled)
  – Default is “stop” or “red”
  – Mechanical interlocks
  – US&S panels
  – Computerized CTC
### Aspect Combinatorics & (NORAC)

<table>
<thead>
<tr>
<th>UPPER HEAD</th>
<th>LOWER HEAD</th>
<th>Signal</th>
<th>RULE (Aspect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>GREEN</td>
<td><img src="image" alt="Green Light" /></td>
<td>281</td>
</tr>
<tr>
<td>GREEN</td>
<td>YELLOW</td>
<td><img src="image" alt="Yellow Light" /></td>
<td>Not Used</td>
</tr>
<tr>
<td>GREEN</td>
<td>RED</td>
<td><img src="image" alt="Red Light" /></td>
<td>281</td>
</tr>
<tr>
<td>YELLOW</td>
<td>GREEN</td>
<td><img src="image" alt="Green Light" /></td>
<td>282</td>
</tr>
<tr>
<td>YELLOW</td>
<td>YELLOW</td>
<td><img src="image" alt="Yellow Light" /></td>
<td>284</td>
</tr>
<tr>
<td>YELLOW</td>
<td>RED</td>
<td><img src="image" alt="Red Light" /></td>
<td>285</td>
</tr>
<tr>
<td>RED</td>
<td>GREEN</td>
<td><img src="image" alt="Green Light" /></td>
<td>283</td>
</tr>
<tr>
<td>RED</td>
<td>YELLOW</td>
<td><img src="image" alt="Yellow Light" /></td>
<td>290</td>
</tr>
<tr>
<td>RED</td>
<td>RED</td>
<td><img src="image" alt="Red Light" /></td>
<td>291</td>
</tr>
</tbody>
</table>
Aspects: NORAC*

Rule: 281
Name: Clear
Indication: Proceed not exceeding Normal Speed

Rule: 281c
Name: Limited Clear
Indication: Proceed at Limited Speed until entire train clears all interlocking or spring switches

Rule: 281a
Name: Cab Speed
Indication: Proceed in accordance with cab signal indication

Rule: 282
Name: Approach Medium
Indication: Proceed approaching the next signal at Medium Speed

Rule: 281b
Name: Approach Limited
Indication: Proceed approaching the next signal at Limited Speed

Rule: 282a
Name: Advance Approach
Indication: Proceed prepared to stop at the second signal. Trains exceeding Limited Speed must reduce to Limited Speed as engine passed the signal

Rule: 283
Name: Medium-Clear
Indication: Proceed at Medium Speed until entire train clears all interlocking or spring switches, then proceed at Normal Speed

Rule: 283a
Name: Medium Approach Medium
Indication: Proceed at Medium Speed until entire train clears all interlocking or spring switches, then approach next signal at Medium Speed

Rule: 284
Name: Approach Slow
Indication: Proceed approaching the next signal at Slow Speed

Rule: 285
Name: Approach
Indication: Proceed prepared to stop at the next signal. Reduce to Medium Speed as engine passes signal

Rule: 286
Name: Medium Approach Indication: Proceed prepared to stop at the next signal. Reduce to Medium Speed as soon as signal is clearly visible

Rule: 287
Name: Slow Clear
Indication: Proceed at Slow Speed until entire train clears all interlocking or spring switches, then proceed at Normal Speed

Advice We Were Given

• Pay attention to modeling details just as you would in any other aspect of model railroading
• Separate the signaling bus from train control
• Solve occupancy then move to signals
• 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 \textit{AND} a software solution
• 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
US&S CTC Panels

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
- Using the JMRI Website, we found CATS (Computer Automated Traffic System)
- 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

• Several outstanding features
  – Uses all the debugging tools in JMRI
  – Great benefits even without signals
  – Signaling based on 4 track speed / 2 or 3 block rules
  – “Pre-programmed” signal logic
  – CTC signals are visible whereas intermediate signals are not visible on the dispatcher panel
  – Can grant track authority
  – Can take track out of service
  – Allows train tracking by train symbol or locomotive #
  – Well written online manuals
CATS Suite is 3 Programs

- **DESIGNER**
  - Used to describe the panel (e.g. track, turnouts & signals)
  - Creates a permanent stored XML file
  - Detector and signal definitions & address mapping
  - Many display options

- **CATS**
  - The runtime application
  - Many runtime controls and display options

- **TRAINSTAT**
  - Tool to allow documenting train location and time (either real time or fast clock)
  - Can be stored to file for archiving
The Signal Template
Default Settings

![Signal Aspect Template]

- Normal:
  - ARA 281: green, red
  - ARA 281B: green, red
  - ARA 282: yellow, red
  - ARA 284: yellow, red
  - ARA 285: yellow, red

- Limited:
  - ARA 281C: green, red
  - CROR 412: green, red
  - CROR 413: yellow, red
  - CROR 414: yellow, red
  - Adv Limited: yellow, red
  - ARA 281D: yellow, red

- Medium:
  - ARA 283: green, red
  - CROR 417: green, red
  - ARA 283A: yellow, red
  - ARA 283B: yellow, red
  - Adv Medium: yellow, red
  - ARA 286: yellow, red

- Slow:
  - ARA 287: green, red
  - CROR 422: green, red
  - CROR 423: green, red
  - CROR 424: green, red
  - Adv Slow: yellow, red
  - ARA 288: yellow, red

- Restricting:
  - ARA 290: red, red
  - Halt: red, red
  - Stop & Proceed: red, red
  - ARA 291: red, red

- Approach Lighting: Yes/No

Accept | Cancel
Define Your Signal Rules

<table>
<thead>
<tr>
<th>Rule</th>
<th>Aspect</th>
<th>Name</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>281b</td>
<td></td>
<td>APPROACH LIMITED</td>
<td>Proceed approaching the next signal at Limited Speed.</td>
</tr>
<tr>
<td>281c</td>
<td></td>
<td>LIMITED CLEAR</td>
<td>Proceed at Limited Speed until entire train clears all interlocking or spring switches, then proceed at Normal Speed. In CSS territory with fixed automatic block signals, trains not equipped with operable cab signals must approach the next signal at Limited Speed.</td>
</tr>
<tr>
<td>282</td>
<td></td>
<td>APPROACH MEDIUM</td>
<td>Proceed approaching the next signal at Medium Speed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rule</th>
<th>Aspect</th>
<th>Name</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>288</td>
<td></td>
<td>SLOW APPROACH</td>
<td>Proceed prepared to stop at next signal. Slow Speed applies until entire train clears all interlocking or spring switches. Then Medium Speed applies.</td>
</tr>
<tr>
<td>289</td>
<td></td>
<td>RESTRICTING</td>
<td>Proceed at Restricted Speed until the entire train has cleared all interlocking and spring switches (if signal is an interlocking or CP Signal) and the leading wheels have: 1. Passed a more favorable fixed signal or 2. Entered non-signalled CSS territory. In CSS territory, trains with operable cab signals may increase speed until the train has run one train length or 560 feet (whichever distance is greater), past a location where a more favorable cab signal was received.</td>
</tr>
</tbody>
</table>
The Signal Template
Edited Settings
The Testing Environment

1. JMRI (simulator)
2. CATS Runtime
3. JMRI Sensor Table
4. JMRI Signal Head Table
5. The System Monitor
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
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

- Two were “passive” (e.g. do not have a signaling card)
  - No detection
  - No signals
  - These represented unchanged modules

- Three were “active” modules (e.g. have a signaling card)
  - These 3 modules all 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

- Wiring strategy:
  - Inner main supplies power & detection to the left
  - Outer main supplies power & detection to the right
The Test Modules

Three “Active Modules

- OS Module
- Crossover Module
- Straight Module

Two “Passive” Modules

- Passive #1
- Passive #2
Signals in 90 Minutes

Starting Point: Ordinary DCC Trackage

1. Add Detection

DO NOT ADD SIGNALS UNTIL DETECTION IS WORKING

2. Add Signals
The Six Permutations

Order #1

Order #2

Order #3

Order #4

Order #5

Order #6
Current MU-ing

Existing

Outer Main Power
Inner Main Power
Third Track Power
18v A/C Power
Accessory DCC

Newly Added

Active Module Outer Main Power
Active Module Inner Main Power
Ground
Spare (Unused)

9/2/2014
Terminal Strip Color
Conventions

Wiring Harness Diagram (11-17-13)

Remove Jumper Wires for Active Module
Outer Main Detail

Active Module Outside Main

1. PASSIVE End Segment
2. INTERMEDIATE TRACK
3. ACTIVE End Segment

WEST

2. INTERMEDIATE TRACK

EAST

9/2/2014
Wiring scheme

Active Module

Detection Required
As module to the left
may be passive

NO Detection Required
Belongs to leftmost block
of module to the right

Detection Required
As module to the right
may be passive

UNinsulated Joiner Tracks

Rail Cut Point

DCCOD

WEST

EAST
Simple Oval
“Splicing” in Active Modules

Tipple

Passive Module

Active Module

Corner

Twin Peaks

Ball Game

Pasture
Linearize the Layout

Linear sequence left to right for CATS “insertion”
Each Module Has It’s Own Designer File

OS Module

Cross-Over Module

Straight Module
CATS Runtime

OS Module

Cross-Over Module

Straight Module
Insertion Demonstration
Runtime 3 Module Section
The Anxious Dispatcher
# Hardware Evaluation Table

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

- We could use more crossovers on the mainlines
- **All/Most** mainline turnouts should be DCC controllable
- 3 ways to throw: throttle, pushbutton, CATS – must agree
- All accessory decoders are fine
- Costs:

<table>
<thead>
<tr>
<th>Product</th>
<th>List</th>
<th># TOs</th>
<th>Cost/TO</th>
<th>On-line$</th>
<th>Cost/TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCE (SW-8)</td>
<td>$59.95</td>
<td>8</td>
<td>$7.49</td>
<td>$49.95</td>
<td>$6.24</td>
</tr>
<tr>
<td>Digitrax (NF)</td>
<td>$39.99</td>
<td>4</td>
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<td>$31.95</td>
<td>$7.99</td>
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<td>NCE (SW-IT)</td>
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<td>Team Digital</td>
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<td>Lenz</td>
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<td>RR-Cirkits†</td>
<td>$32.25</td>
<td>8</td>
<td>$4.03</td>
<td>$27.95</td>
<td>$3.49</td>
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</tbody>
</table>

† Not a DCC stationary decoder

9/2/2014
Signal types

• The module group standard will be the three triangular light G-Type signal with any number of heads. Green on the right.

• However, based upon modeler preference, any physical signal type is acceptable.

• Electrically, we will only support common anode, lighting one LED or bulb per output. Common anode B&O or PRR signals are fine. Common cathode signals can be made to work but with considerable effort that will come only from the module owner.

• We are considering and working on approaches to removable plugs. Currently nothing formal to report.
Signal Connections
Work in progress
3 Choices for Searchlights

- 2 lead bipolar LED
- 3 lead Common Cathode LED
- 4 lead Common Anode LED
Commercial Signals

NJ International
#1053 $32.99
#1054 $34.99
#1056 $36.99

Tomar
#H-855 $26.30
#H-865 $49.70

Oregon Rail Supply (KITS)
#116 $11.95
#538 $19.95

Custom Signal Systems
G-Double $30.00
SB-G $20.00

South Bend
#235 $34.95
#238 $44.95
#239 $44.95

Custom Signal (Atlas)
Common Cathode

Integrated Signal Systems

9/2/2014
Detection – Chubb DCCOD

- How is it powered? 12v unregulated DC
- Does it use transformer coupling? YES
- Is the sensitivity adjustable? YES
- Built-in de-bounce (3.5 sec off, 250 ms on)
- How much resistance in cars? 4700 Ohms
- Fraction of cars with resistors? 100% - 1 Axle
- Low cost source of resisted wheelsets
- C/MRI DCCODs as kits (around $10)
New Kids on the Block

**cpNode**

- Arduino based
- 16 Configurable ports
- Configurable node address
- Configurable baud rate
- Behaves like an SMINI
- Small: 3 x 2 ½ inches
- Low cost
- Built-in Turnout control
- Expandable
## Straightforward Modules

<table>
<thead>
<tr>
<th>Requirements</th>
<th>cpNode: 10 outputs, 6 inputs</th>
<th>SMINI:  48 outputs, 24 inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Sensors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Outputs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Diagram

- **DCCOD**
- **DCCOD**
Requirements:
- 4 two headed G-type Signals
- 26 Turnouts (outputs)

(cpNode with an IOX16
- 6 Sensors (inputs)
- 6 DDCODs)
Pasture (documentation)
Chubb Board Address = 2

TRACK Segment Outer 1
Block Name: Pasture OM-E – TS1
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2002
  Position: Close
Unoccupied:
  Address: CS 2002
  Position: Throw

TRACK Segment Outer 2
Block Name: Pasture OM-E – TS2
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2004
  Position: Close
Unoccupied:
  Address: CS 2004
  Position: Throw

TRACK Segment Outer 3 (active West ditzel)
Block Name: Pasture OM-E – TS3
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2006
  Position: Close
Unoccupied:
  Address: CS 2006
  Position: Throw

TRACK Segment Inner 1
Block Name: Pasture IM-W – TS1
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2005
  Position: Close
Unoccupied:
  Address: CS 2005
  Position: Throw

TRACK Segment Inner 2
Block Name: Pasture IM-W – TS2
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2003
  Position: Close
Unoccupied:
  Address: CS 2003
  Position: Throw

TRACK Segment Inner 3 (active East ditzel)
Block Name: Pasture IM-W – TS3
Station: Pasture
Signal Discipline: APB-2
Occupied:
  Address: CS 2001
  Position: Close
Unoccupied:
  Address: CS 2001
  Position: Throw

TRACK Segment Inner 0
Undefined Inner Main End Track Segment

TRACK Segment Outer 0
Undefined Outer Main End Track Segment

Undefined Outer Main End Track Segment

Undefined Inner Main End Track Segment
## Manual Documentation

### HUB CATS File Development Documentation

#### Upton Yard Signal Program file East Module Signal Block Definitions

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Signal Discipline</th>
<th>Address &quot;CT&quot;</th>
<th>Actual Signal Location on Module</th>
<th>Define Signal</th>
<th>Panel Placement</th>
<th>Details/Signal Head Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Top</td>
<td>Head0</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yellow</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Green</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Middle</td>
<td>Head1</td>
<td>Red</td>
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<td>Green</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bottom</td>
<td>Head2</td>
<td>Red</td>
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<td>Green</td>
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<td>Top</td>
<td>Head0</td>
<td>Red</td>
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<td>Green</td>
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<td>Head Name</td>
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<td>Color</td>
<td>Prefix</td>
<td>Address</td>
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<td>13027</td>
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<td>CT</td>
<td>13025</td>
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<td>CT</td>
<td>13029</td>
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<td>NewtonJct IM West Upper</td>
<td>green</td>
<td>CT</td>
<td>13032</td>
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<td>CT</td>
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<td>CT</td>
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<td>CT</td>
<td>13034</td>
<td>throw</td>
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<td></td>
<td>flashing green</td>
<td>CT</td>
<td>13025</td>
<td>throw</td>
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</table>
New Challenges

• Detection sensitivity
• Compatibility with other modular groups
• Approaches to removable signals
• Track complexity
  – Wiring track power
  – The bridge module has become the “draw bridge” module
  – Linearize the signal bus
### Clearance Form “A”

- This is the form that makes a train a train.
- We use it to fill in the needed info for train tracking.

<table>
<thead>
<tr>
<th>CLEARANCE FORM “A”</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATION</td>
<td>UPTON YARD</td>
</tr>
<tr>
<td>CONDUCTOR AND ENGINEER</td>
<td>DICK JOHANNES</td>
</tr>
<tr>
<td>ORDERS (If no orders, indorse “NONE”)</td>
<td></td>
</tr>
<tr>
<td>OK AT (Time)</td>
<td>1100 AM</td>
</tr>
<tr>
<td>CHIEF-DISPATCHER</td>
<td></td>
</tr>
<tr>
<td>DO NOT LEAVE BEFORE (Fill in when necessary to comply with rule 221)</td>
<td></td>
</tr>
<tr>
<td>TRAIN NAME</td>
<td>EDPO</td>
</tr>
<tr>
<td>BLOCK (Fill in only when operating under Manual Block System)</td>
<td></td>
</tr>
<tr>
<td>LEAD LOCOMOTIVE</td>
<td>#510</td>
</tr>
<tr>
<td># CARS (At Origination)</td>
<td>14</td>
</tr>
</tbody>
</table>

Conductor and engineer must have a copy and see that their train is correctly designated in the above form, also that the numbers of all train orders received correspond with numbers inserted above.

DA FORM 4091-R, 1 May 93

REPLACES DA FORM 55-200
1 Jan 90 WHICH IS OBSOLETE
Architecture
Summary

• Signaling a 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
• Pre-setup: Create linear list of modules “importing” the layout plan for that particular setup into CATS
• Setup = 1) Link the physical modules 2) Load the CATS equivalent 3) Run
• HUB modular railroad uses:
  1. Lenz DCC with a LAN-USB connection
  2. C/MRI SMINI boards + (cpNodes & SMicros)
  3. C/MRI DCCOD occupancy detectors
  4. JMRI & CATS software
References (Books)

- **Railroad Operation and Railway Signaling.** Edmund J Phillips. Simmons-Boardman 1942
- **All About Signals.** John Armstrong, Kalmbach, 1967.
References (Journals)

References (Web Sites)

- Carsten Lundstens site: http://www.lundsten.dk/us_signaling/index.html
- Norac Simulator: http://raildata.railfan.net/java/DivRte/NORAC.htm
- Railroad Signals: http://www.railroadsignals.net/
- Railroad Signals of the US: http://www.railroadsignals.us/
- JMRI: http://jmri.sourceforge.net/
- CATS: http://home.comcast.net/~kb0oys/
- CMRI: http://www.jlcenterprises.net/
- Custom Signals: http://www.customsignals.com/
- ISS: http://www.integratedsignalsystems.com/
- Signals by Spreadsheet: http://www.signalsbyspreadsheet.com/
- Railroad Circuits: http://rr-cirkits.com/
- Logic Rail: http://www.logicrailtech.com/
The NMRA HUB Division
Modular Railroad Signal Committee

Signaling Presentations
HUB Modular Railroad Signaling Documentation
Address & Number Assignments
Signal Committee Meeting Notes & BOD Reports
Vendor Links

Committee Origins & Goals
Discussions on signaling the HUB Modular Railroad began in the spring of 2010. At the 75th NMRA convention that summer, the project started to take root when Dick Johannes, Jeff Gerow and Stan Ames attended a Signal Seminar at the convention. In addition, Dick attended any and every session on signals on model railroads he could find, with the other two members attending many of these alongside him. They returned to Boston energized with the concept that signals could be done on a modular railroad. The problem was how, since signal systems are designed for static layouts. Additional members of the HUB Division joined the effort, which evolved into the HUB Modular Railroad Signal Committee as we know it today.

At present, Dick Johannes is the Chairman, and the committee members are (in alphabetical order) Stan Ames, Ken Belovarac, Gerry Covino, Manny Escobar, Jeff Gerow, David "Shack" Haralambou, Mark Harlow, Bill Powers and Peter Watson.

The goal of the HUB's Signal Committee was to research, design and build a true modular signaling approach for the HUB's modular railroad. Signaling had previously been done on other modular railroads, but the solutions required a specific set of modules arranged in a specific order. This approach was not adequate for the HUB, due to the variety of layout shapes and sizes that we display at our shows each year. An additional complexity was the fact that the same set of modules are not always displayed together, because the combined total number of modules owned by modular group members is more than can be used in any one show. So our Module Coordinator routinely rotates through the available modules to ensure that all members have an opportunity to show their module(s) at least a couple times a year.
THANK YOU!

johannes4@comcast.net