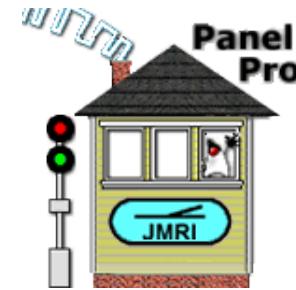


Running Trains with JMRI's Dispatcher

Dave Duchamp

Dick Bronson (Co-Presenter)

Bob Jacobsen (Co-Presenter)



What is Dispatcher?

Dispatcher provides functionality and organizes information for dispatching trains on a model railroad layout.

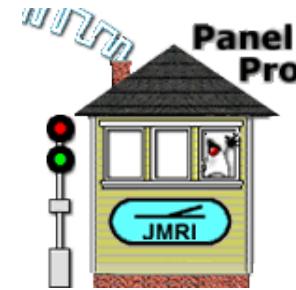
Dispatcher is **not** designed to be prototypical, and **not** designed to replace a human dispatcher.

Dispatcher is designed to make dispatching easier and more fun.

It's main functions are:

- Support running multiple trains manually (*human engineer*) and/or automatically (*virtual engineer*).
- Creating **Active Trains** by linking a **Transit** and a Train.
- Allocating **Sections** to Active Trains, and releasing when not needed.

Optionally, it can automatically set Turnouts as Sections are allocated.



What is a Section?

A **Section** is a group of one or more connected **Blocks** that may be allocated together to a train running in a given direction.

A Section has three states:

- **FREE** – not allocated.
- **FORWARD** – allocated for travel in the “forward” direction.
- **REVERSE** – allocated for travel in the “reverse” direction.

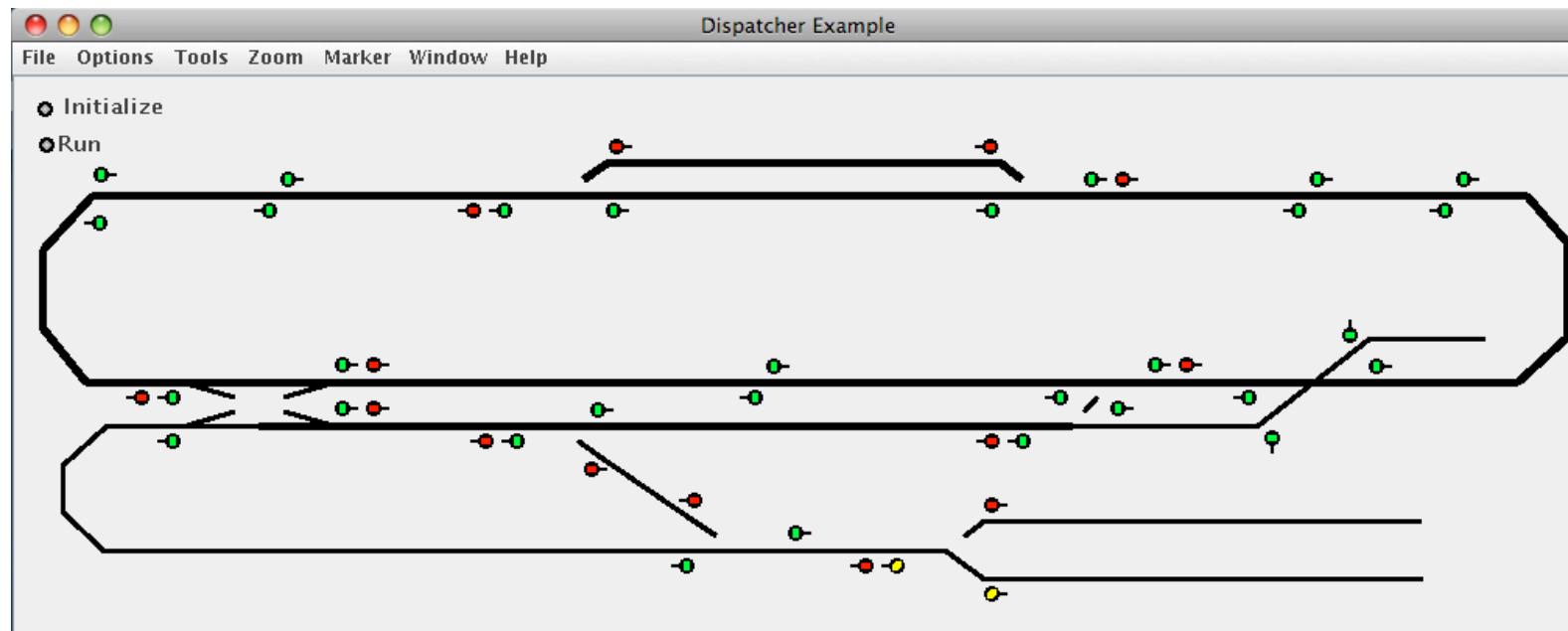
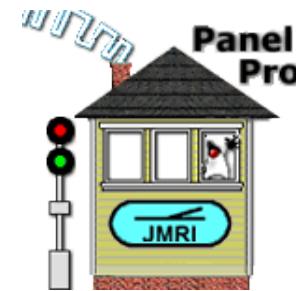
Dispatcher requires that **Sections** (and **Transits**) be set up before running trains that use them.

Layout must have **Blocks** set up and functional before Sections can be defined.



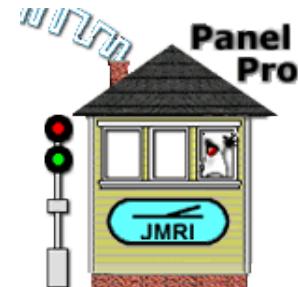
Demo Layout

(Made with Layout Editor)





Set up Sections using the **Section Table**



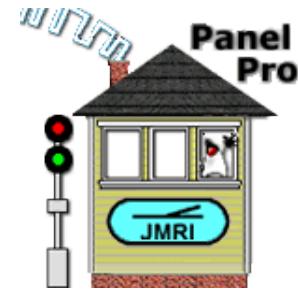
PanelPro

File Edit Tools Roster Panels Operations LocoNet CMRI Debug Window Help

Programmers >

Tables > Turnouts
Sensors
Lights
Signal Heads
Signal Masts
Signal Groups
Reporters
Memory Variables
Routes
LRoutes
Logix
Occupancy Blocks
Blocks
Sections > **Sections** 
Transits
Audio

Part of the JMRI project
PanelPro
Simulator
0_20 (en_US)



Selecting the Section Table for our Demo Layout
shows that its 18 Blocks are grouped into 11 Sections.

Section Table

System Name	User Name	State	Comment		First Block	Last Block	
IY1	1234	FREE		Delete	IB2(Block1)	IB4(Block4)	Edit
IY2	5	FREE		Delete	IB5(Block5)	IB5(Block5)	Edit
IY3	6	FREE		Delete	IB6(Block6)	IB6(Block6)	Edit
IY4	789	FREE		Delete	IB7(Block7)	IB9(Block9)	Edit
IY5	Industry	FREE		Delete	IB12(Industry)	IB12(Industry)	Edit
IY6	Staging 1	FREE		Delete	IB13(Staging 1)	IB13(Staging 1)	Edit
IY7	Staging 2	FREE		Delete	IB14(Staging 2)	IB14(Staging 2)	Edit
IY8	Upper Main	FREE		Delete	IB19(Upper Main W)	IB20(Upper Main E)	Edit
IY9	Lower Main	FREE		Delete	IB18(Lower Main W)	IB17(Lower Main E)	Edit
IY10	Staging Access	FREE		Delete	IB15(Staging Access 1)	IB15(Staging Access 1)	Edit
IY11	Staging Alt	FREE		Delete	IB16(Staging Access 2)	IB16(Staging Access 2)	Edit



**Blocks must be
fully defined,
including Paths.**

“FORWARD”
direction is from top
Block to bottom
Block.

User selects the
Travel Direction for
each Entry Point to
the Section.

Trains can traverse
Section in either
direction.

Add/Edit Section

Window Help

System Name: IY1 User Name: 1234

Blocks in Section (at least 1 is required)

System Name:	User Name:
IB2	Block1
IB1	Block2
IB3	Block3
IB4	Block4

Delete All Blocks IB5(Block5) Add Selected Block

Table of Entry Points

Block Entering From	Entry Block	Travel Direction
IB19(Upper Main W)(West)	IB2(Block1)	FORWARD
IB18(Lower Main W)(West)	IB2(Block1)	FORWARD
IB5(Block5)(West)	IB4(Block4)	REVERSE
IB6(Block6)(West)	IB4(Block4)	REVERSE

Note: FORWARD direction is from the top Block toward the bottom Block.

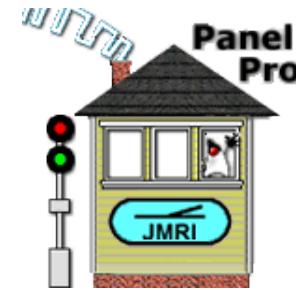
Direction Sensors (Optional)

Forward Sensor: IS65 Reverse Sensor: IS66

Stopping Sensors (Optional)

Forward Stopping Sensor: Reverse Stopping Sensor:

Cancel Update



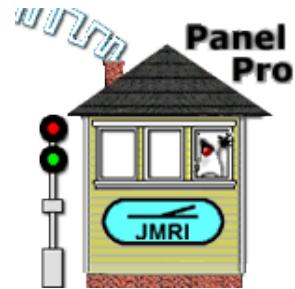
What are Direction Sensors?

Direction Sensors are internal sensors whose state reflects the allocation status of their Section.

- FREE – Both Direction Sensors ACTIVE
- FORWARD – Forward Sensor INACTIVE, Reverse Sensor ACTIVE
- REVERSE – Reverse Sensor INACTIVE, Forward Sensor ACTIVE

Correctly inserting Direction Sensors into Signal Logic, will cause signals to block travel in unallocated directions, resulting in simple APB Signaling.

Tools are available for inserting and removing Direction Sensors into/from Signal Logic.

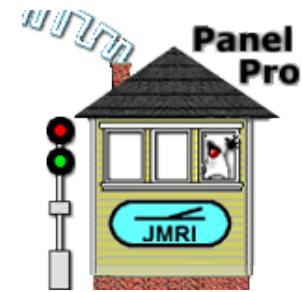


Select tool to put Direction Sensors into Signal Logic.

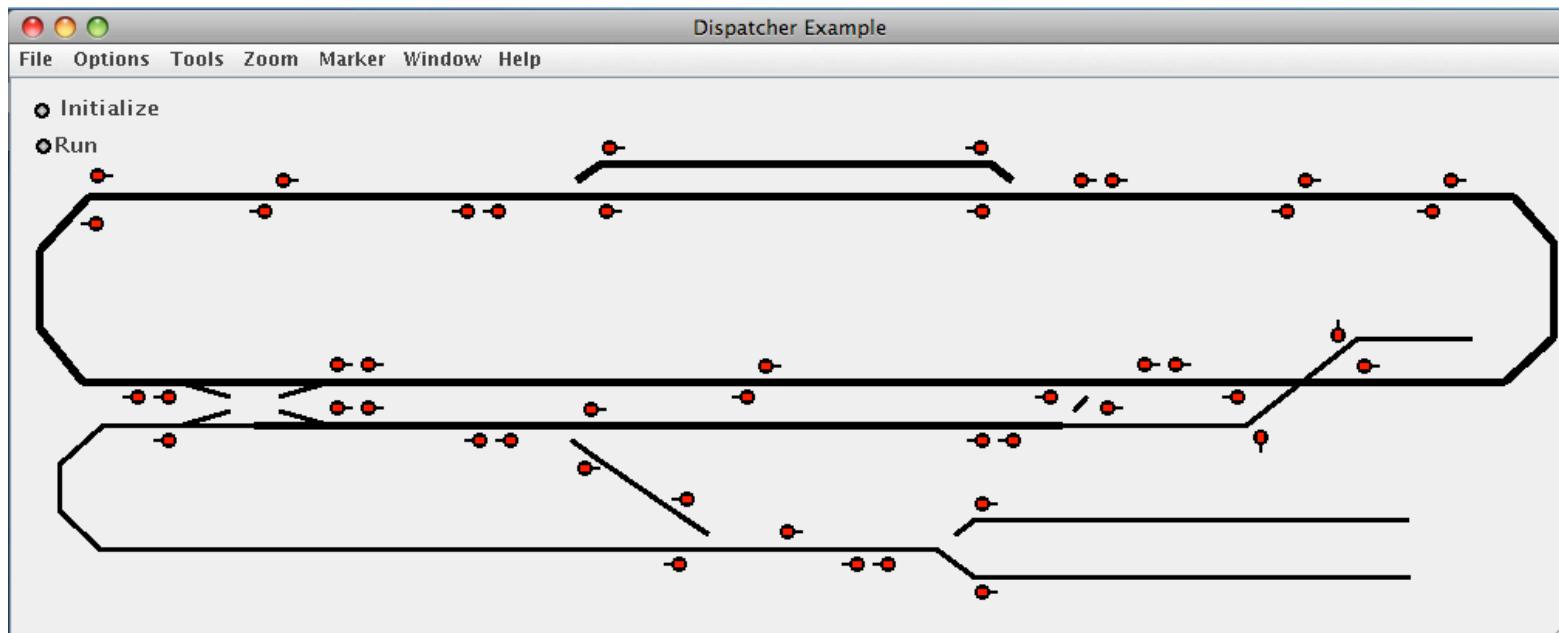
Section Table

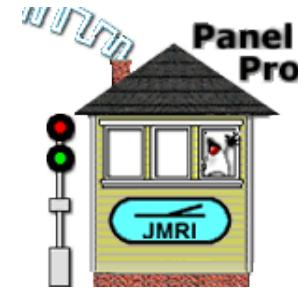
File Window Help Tools		Validate All Sections...			First Block	Last Block	
System ...	User Name	Set Direction Sensors in Logic...			IB2(Block1)	IB4(Block4)	Edit
IY1	1234	Remove Direction Sensors from Logic...			IB15(Staging Access 1)	IB15(Staging Access 1)	Edit
IY10	Staging Access				IB16(Staging Access 2)	IB16(Staging Access 2)	Edit
IY11	Staging Alt	FREE		Delete	IB5(Block5)	IB5(Block5)	Edit
IY2	5	FREE		Delete	IB6(Block6)	IB6(Block6)	Edit
IY3	6	FREE		Delete	IB7(Block7)	IB9(Block9)	Edit
IY4	789	FREE		Delete	IB12(Industry)	IB12(Industry)	Edit
IY5	Industry	FREE		Delete	IB13(Staging 1)	IB13(Staging 1)	Edit
IY6	Staging 1	FREE		Delete	IB14(Staging 2)	IB14(Staging 2)	Edit
IY7	Staging 2	FREE		Delete	IB19(Upper Main W)	IB20(Upper Main E)	Edit
IY8	Upper Main	FREE		Delete	IB18(Lower Main W)	IB17(Lower Main E)	Edit
IY9	Lower Main	FREE		Delete			

Add ...



No Sections are allocated, so all Signal Heads are Red!



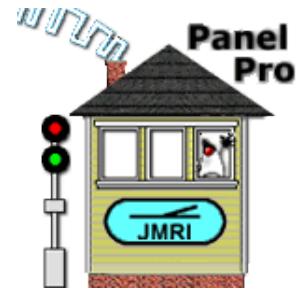


What is a Transit?

A Transit is a group of two or more connected Sections that describes a route around the layout for a train traveling in a given direction.

Transits are *activated* in the **Dispatcher** window, where a Transit is paired with a Train to create an **Active Train**.

Transits are set up in the **Transit Table**.



Two Transits have been defined for our demo layout.

Transit Table

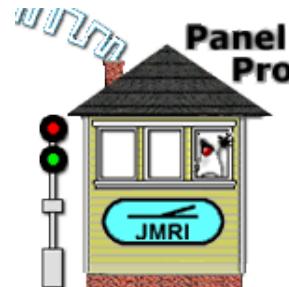
System N...	User Name	State	Comment			
I211	clockwise	IDLE		Delete	Edit	Duplicate
I212	counter-clockwise	IDLE		Delete	Edit	Duplicate

Add ...



“Clockwise” Transit

Note alternate Sections at siding.



Add/Edit Transit

Window Help

System Name: IZ11 User Name: clockwise

Sections in Transit (at least 2 are required)

Order	Section	Actions	Direction	Alternate
1	IY6(Staging 1)	View/Add/Edit Actions	FORWARD	Primary
2	IY10(Staging Access)	View/Add/Edit Actions	FORWARD	Primary
3	IY9(Lower Main)	View/Add/Edit Actions	REVERSE	Primary
4	IY1(1234)	View/Add/Edit Actions	FORWARD	Primary
5	IY2(5)	View/Add/Edit Actions	REVERSE	Primary
5	IY3(6)	View/Add/Edit Actions	REVERSE	Alternate

Delete All Sections **Add Next Section**

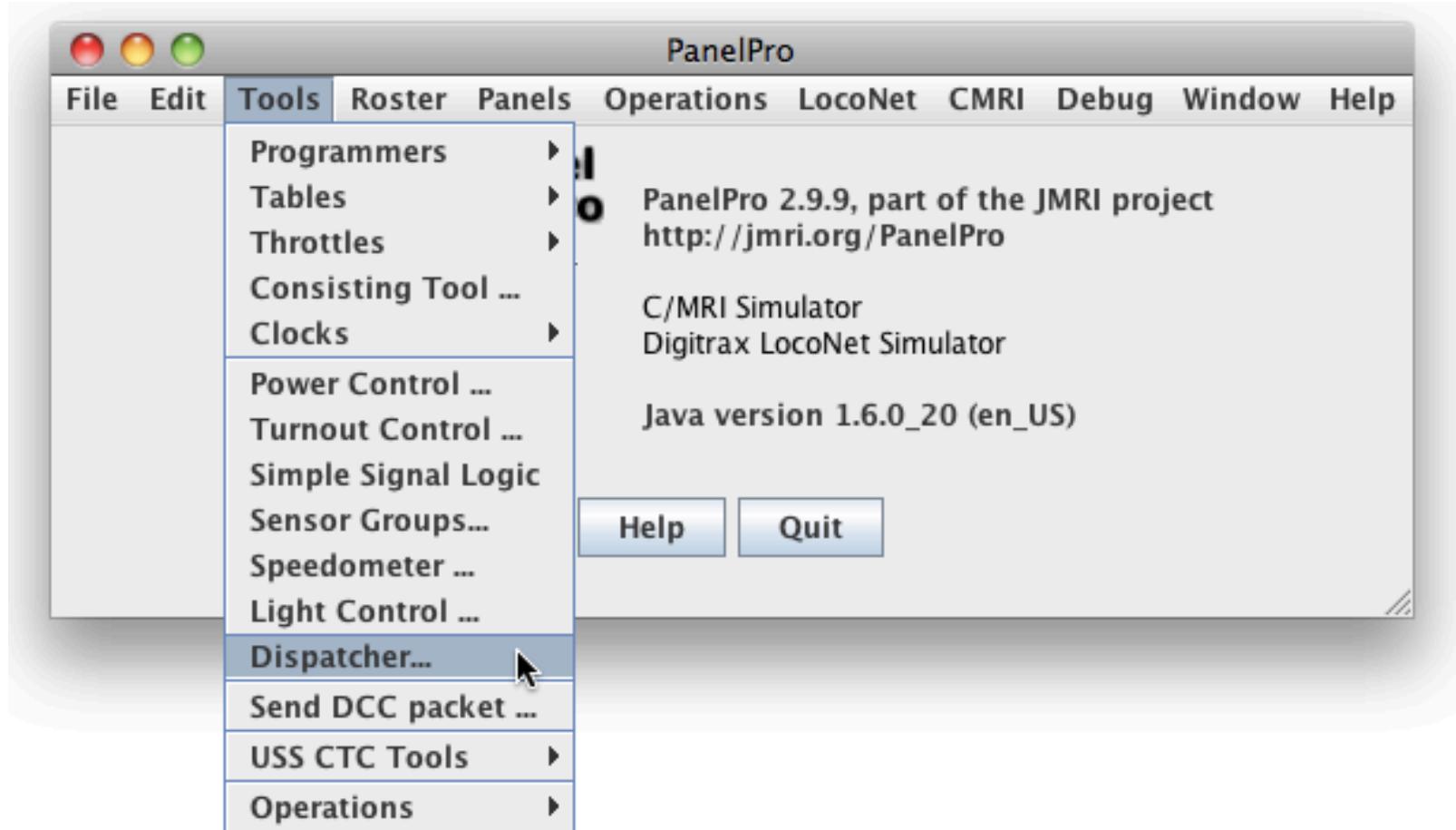
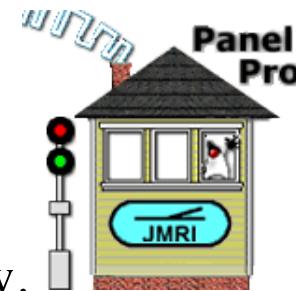
IY7(Staging 2) **Add Alternate Section**

Cancel **Update**



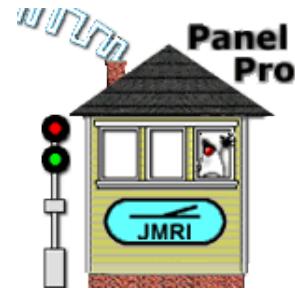
After all mainline Sections and at least one
Transit have been defined—

Select “**Dispatcher...**” in the main PanelPro window.





The dispatcher controls the layout via the
Dispatcher Window.



Three Tables:

Active Trains

Requested
Allocations

Allocated
Sections

Dispatcher

Options Window Help

Active Trains

Transit	Train	Train Type	Train Status	Mode	Allocated Section	Next Section

New Train... Allocate Extra... Cancel Auto Restart... Terminate Train...

Requested Allocations waiting for Dispatch

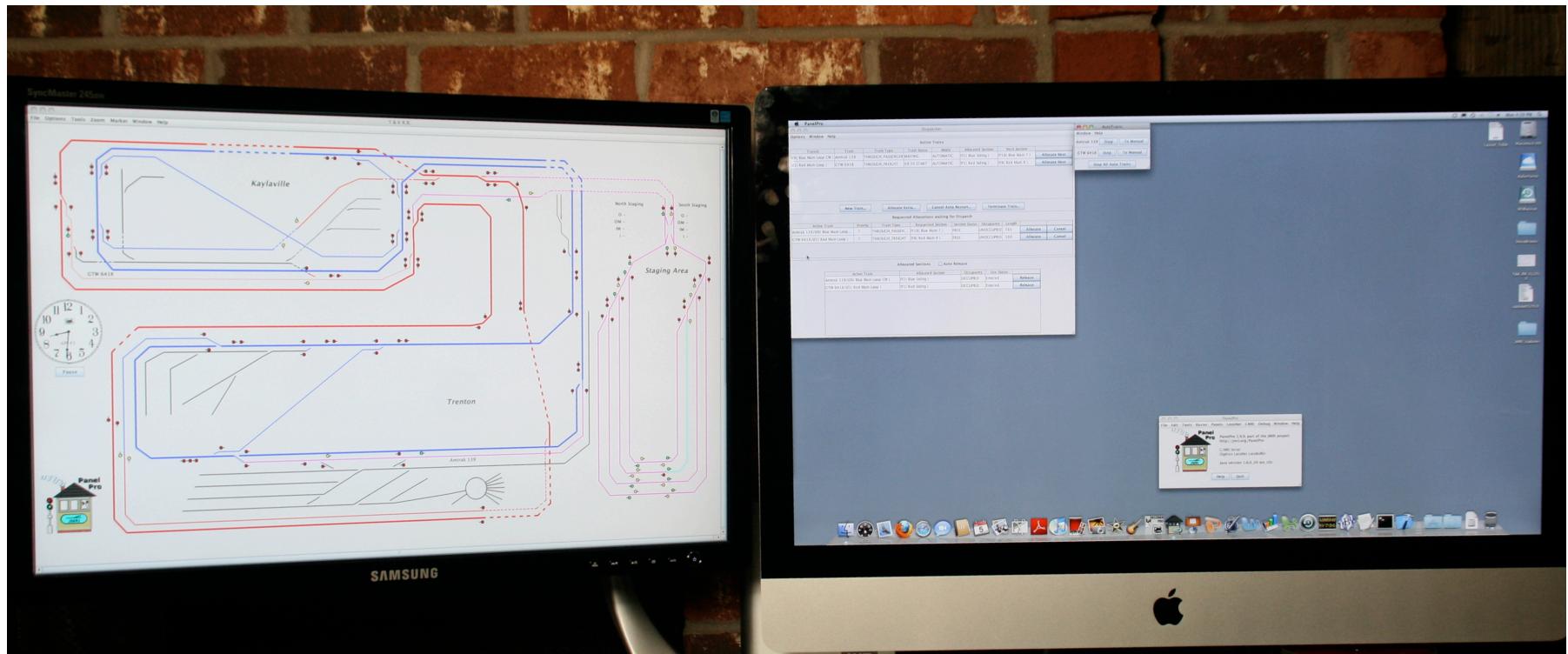
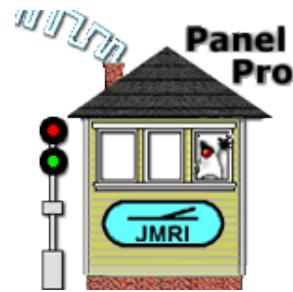
Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length

Allocated Sections Auto Release

Active Train	Allocated Section	Occupancy	Use Status

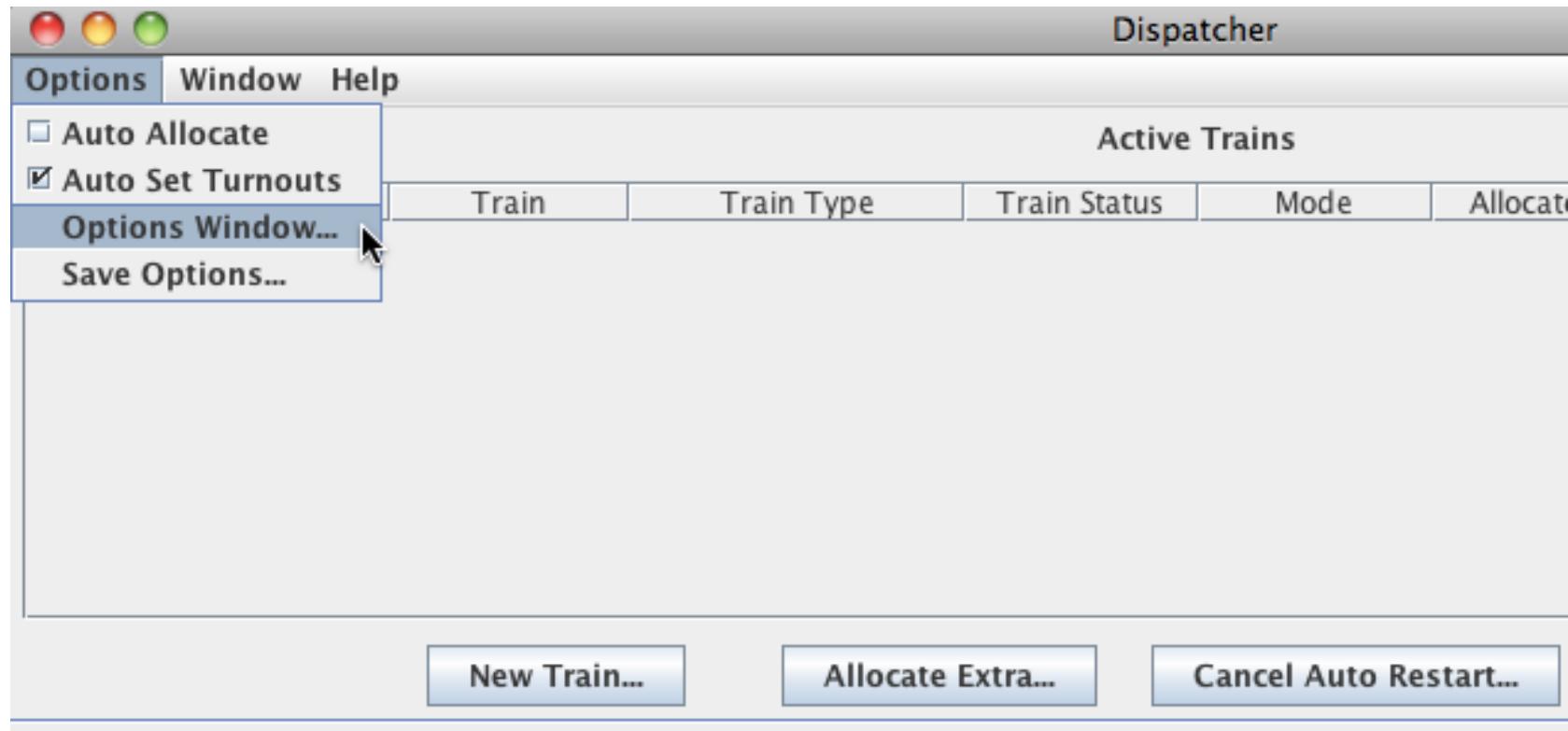
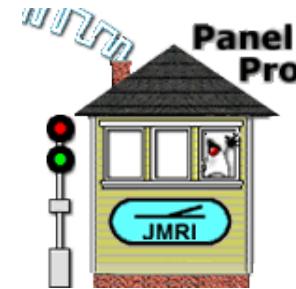


Dispatcher Window is large. Works best with multiple monitors, but multiple monitors are not required.





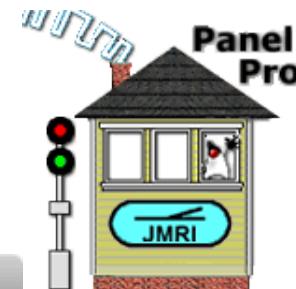
Click “**Options Window...**” in the Dispatcher “**Options**” menu.





Dispatcher Options Window

Set options, then click “Apply”.



Options

Window Help

Use connectivity from Layout Editor panel: T & K R.R. ▾

Trains from Roster Trains from Operations Trains from User Entry

Layout has block detection hardware.

Automatically allocate Sections to Active Trains.

Automatically set turnouts when a Section is allocated.

Use short Active Train names.

Place train name in starting Block

Use alternate color for allocated Blocks

Place train name in allocated Blocks

Layout Scale: HO - 1:87 ▾

Units: Scale Feet Scale Meters

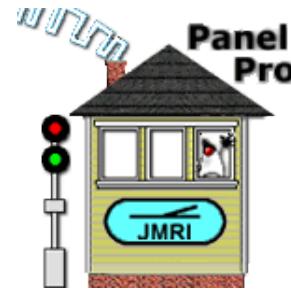
Note:

To save these Options and have them automatically set when restarting, select

Save Options...
in Dispatcher's Option menu.



To create an **Active Train**, ready to be dispatched, click “**New Train...**” below the Active Trains table.



Dispatcher

Options Window Help

Active Trains

Transit	Train	Train Type	Train Status	Mode	Allocated Section	Next Section
---------	-------	------------	--------------	------	-------------------	--------------

New Train... Allocate Extra... Cancel Auto Restart... Terminate Train...



Activate New Train Window

Select a Transit and a Train. Enter other information and click “**Add New Train**”.

Activate New Train

Window Help

Transit : IZ11(clockwise) Train: BNSF7665

Train in selected Transit.

Starting Location of Train : IB13(Staging 1)-1

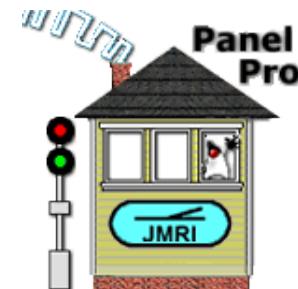
Destination Location of Train: IB13(Staging 1)-10

Reset When Done (Continuous running)

Priority : 5 Train Type: THROUGH_FREIGHT

Delayed Start Departure Time: 08 : 00

Run Train Automatically

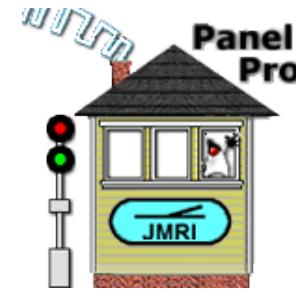


To reuse this train at a later date, click **Save Train Info** after all information is set.

Train information is retrieved by clicking **Load Train Info** when this window is first displayed.



The first Section was automatically allocated. The next two were allocated using the “Allocate Next” button.



Dispatcher

Options Window Help

Active Trains

Transit	Train	Train Type	Train Status	Mode	Allocated Section	Next Section	Allocate Next
IZ11(clockwise)	BNSF7665	LOCAL_FREIGHT	RUNNING	DISPATCHED	IY9(Lower Main)	IY1(1234)	<input type="button" value="Allocate Next"/>

New Train... Allocate Extra... Cancel Auto Restart... Terminate Train...

Requested Allocations waiting for Dispatch

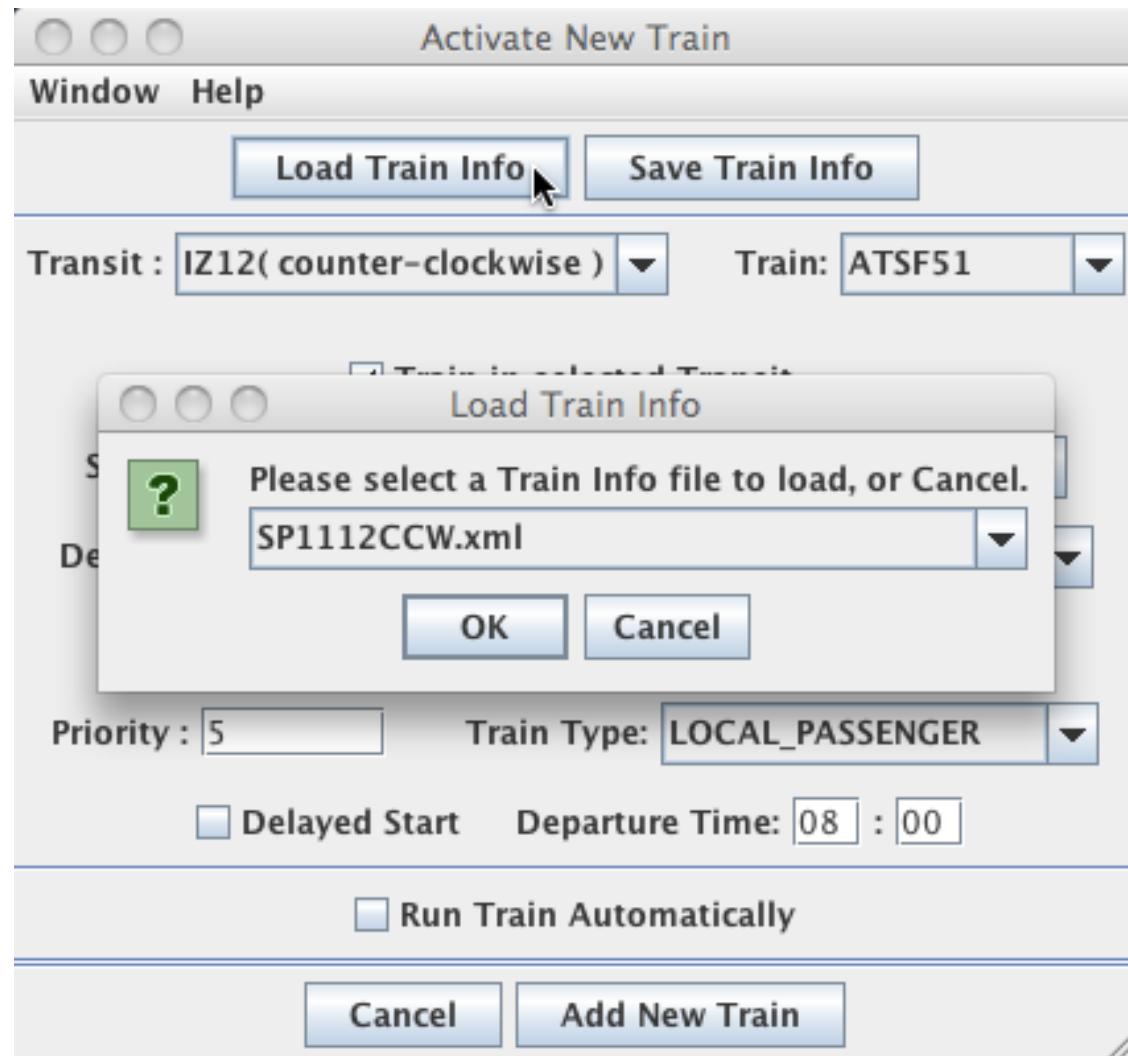
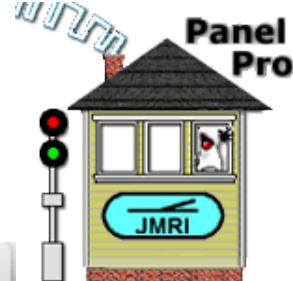
Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length

Allocated Sections Auto Release

Active Train	Allocated Section	Occupancy	Use Status	
BNSF7665/IZ11(clockwise)	IY6(Staging 1)	OCCUPIED	Entered	<input type="button" value="Release"/>
BNSF7665/IZ11(clockwise)	IY10(Staging Access)	UNOCCUPIED	Not Entered	<input type="button" value="Release"/>
BNSF7665/IZ11(clockwise)	IY9(Lower Main)	UNOCCUPIED	Not Entered	<input type="button" value="Release"/>

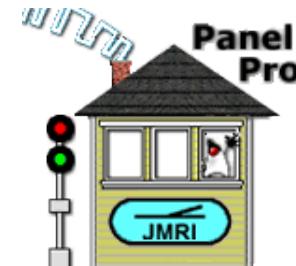


Second train – use “**Load Train Info**” then click “**Add New Train**”.





The first Section was automatically allocated. Attempted to allocate another using the “Allocate Next” button.



Dispatcher

Options Window Help

Active Trains

Transit	Train	Train Type	Train Status	Mode	Allocated Section	Next Section	
IZ11(clockwise)	BNSF7665	LOCAL_FREIGHT	WAITING	DISPATCHED	IY1(1234)	IY2(5)	Allocate Next
IZ12(counter-clockwise)	SP1112	THROUGH_FREIGHT	WAITING	DISPATCHED	IY7(Staging 2)	IY10(Staging Access)	Allocate Next

New Train... Allocate Extra... Cancel Auto Restart... Terminate Train...

Requested Allocations waiting for Dispatch

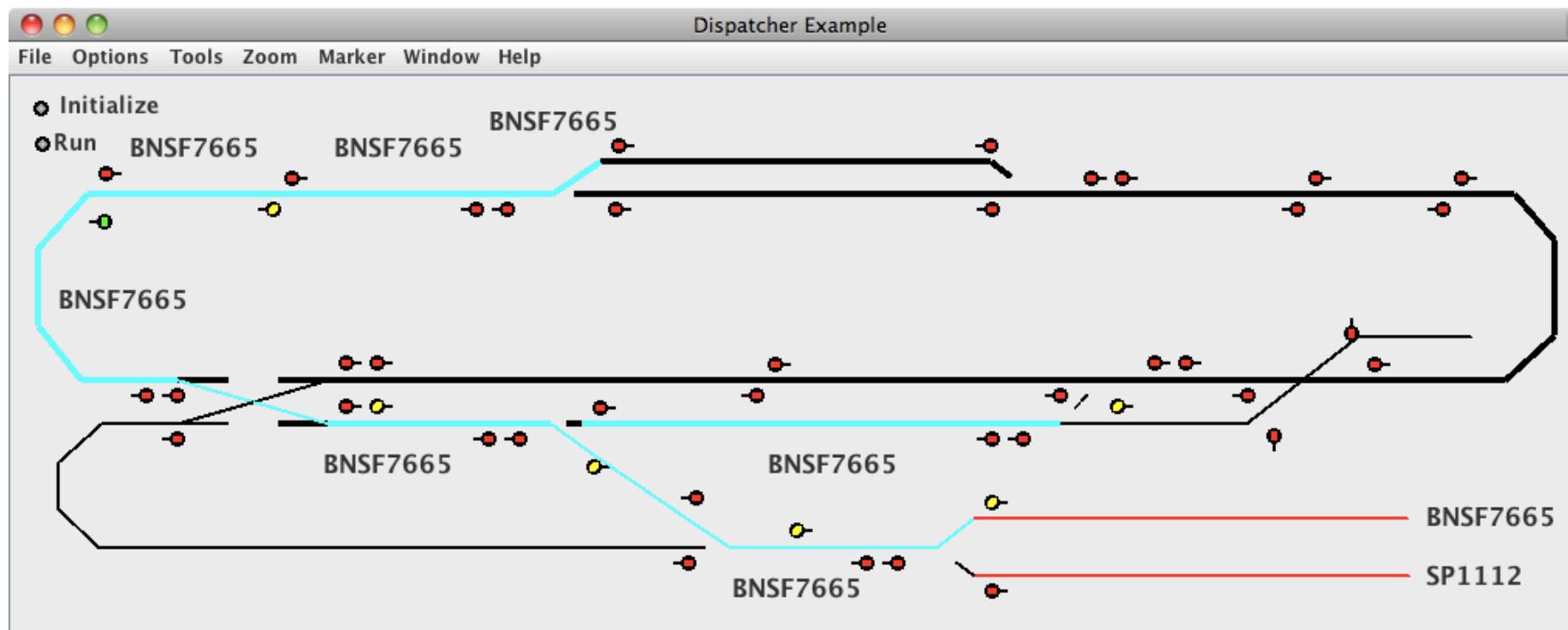
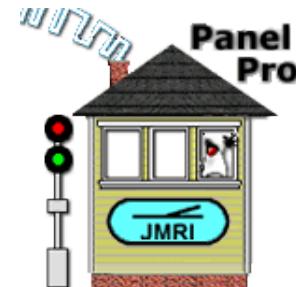
Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length	Allocate	Cancel
SP1112/IZ12(counter-clockwise)	5	THROUGH_FREIGHT	IY10(Staging Access)	ALLOCATED	UNOCCUPIED	0	Allocate	Cancel

Allocated Sections Auto Release

Active Train	Allocated Section	Occupancy	Use Status	
BNSF7665/IZ11(clockwise)	IY6(Staging 1)	OCCUPIED	Entered	Release
BNSF7665/IZ11(clockwise)	IY10(Staging Access)	UNOCCUPIED	Not Entered	Release
BNSF7665/IZ11(clockwise)	IY9(Lower Main)	UNOCCUPIED	Not Entered	Release
BNSF7665/IZ11(clockwise)	IY1(1234)	UNOCCUPIED	Not Entered	Release
SP1112/IZ12(counter-clockwise)	IY7(Staging 2)	OCCUPIED	Entered	Release

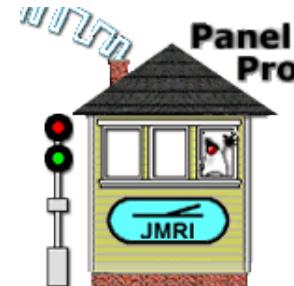


Demo Layout





Active Trains Table



Dispatcher

Options Window Help

Active Trains

Transit	Train	Train Type	Train Status	Mode	Allocated Section	Next Section	
IY11(clockwise)	BNSF7665	LOCAL_FREIGHT	WAITING	DISPATCHED	IY1(1234)	IY2(5)	Allocate Next
IY12(counter-clockwise)	SP1112	THROUGH_FREIGHT	WAITING	DISPATCHED	IY7(Staging 2)	IY10(Staging Access)	Allocate Next

New Train... Allocate Extra... Cancel Auto Restart... Terminate Train...

New Train... - Click to create a new Active Train.

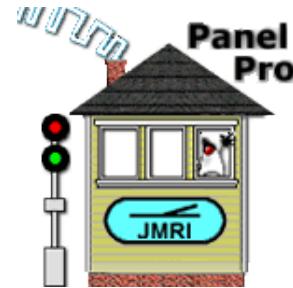
Allocate Extra... - Click to allocate a Section to an Active Train that is not the next Section in the Transit.

Cancel Auto Restart... - Click to cancel Auto Restart of an Active Train.

Terminate Train... - Click to terminate an Active Train and release its Transit and Train for future use.

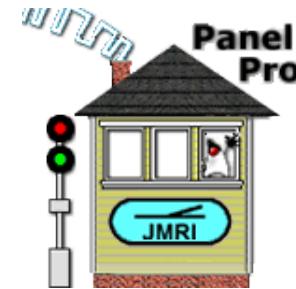


Requested Allocations Table



Requested Allocations waiting for Dispatch

Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length	Allocate	Cancel
SP1112/I212(counter-clockwise)	5	THROUGH_FREIGHT	IY10(Staging Access)	ALLOCATED	UNOCCUPIED	0	Allocate	Cancel

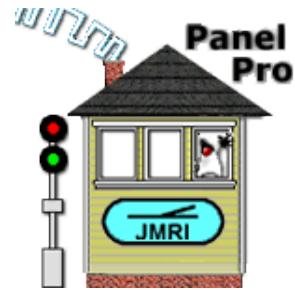


Allocated Sections Table

(Sections are released here.)

Allocated Sections		<input type="checkbox"/> Auto Release		
Active Train	Allocated Section	Occupancy	Use Status	
BNSF7665/IZ11(clockwise)	IY6(Staging 1)	OCCUPIED	Entered	Release
BNSF7665/IZ11(clockwise)	IY10(Staging Access)	UNOCCUPIED	Not Entered	Release
BNSF7665/IZ11(clockwise)	IY9(Lower Main)	UNOCCUPIED	Not Entered	Release
BNSF7665/IZ11(clockwise)	IY1(1234)	UNOCCUPIED	Not Entered	Release
SP1112/IZ12(counter-clockwise)	IY7(Staging 2)	OCCUPIED	Entered	Release

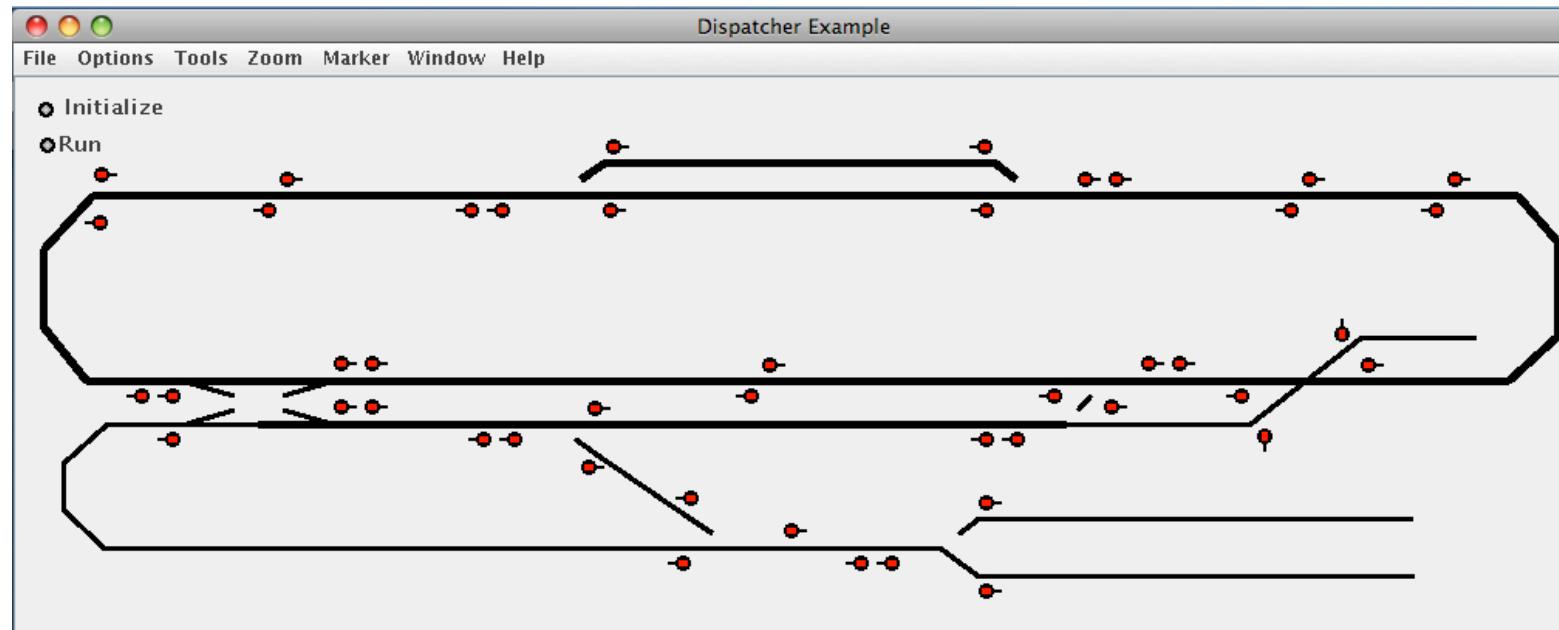
Checking “Auto Release” will automatically release Allocated Sections when Occupancy shows UNOCCUPIED and Use Status shows Exited (Allocated Section has been Entered and Exited.)



Run Dispatcher Example Simulation.

Two trains crossing at the passing siding.

Logix for each train--follows signals to advance.





Automatic
Running
Selecting
“Run Train
Automatically”
brings up items
specific to
automatically
running trains.

Activate New Train

Window Help

Load Train Info Save Train Info

Transit : IZ1A(Red Main LoopA) Train: GP60 5835

Train in selected Transit.

Starting Location of Train : IB1(Red Siding)-1

Destination Location of Train: IB49(Red Main 5)-9

Reset When Done (Continuous running)

Priority : 5 Train Type: LOCAL_FREIGHT

Delayed Start Departure Time: 08 : 00

Run Train Automatically

Speed Factor: 0.6 Default Maximum Speed: 0.6

Ramp Rate: RAMP_FAST

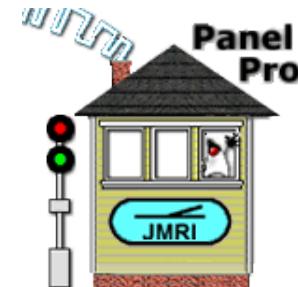
Loco has sound decoder. Run in reverse

All cars have resistance wheels Maximum Train Length: 112.0

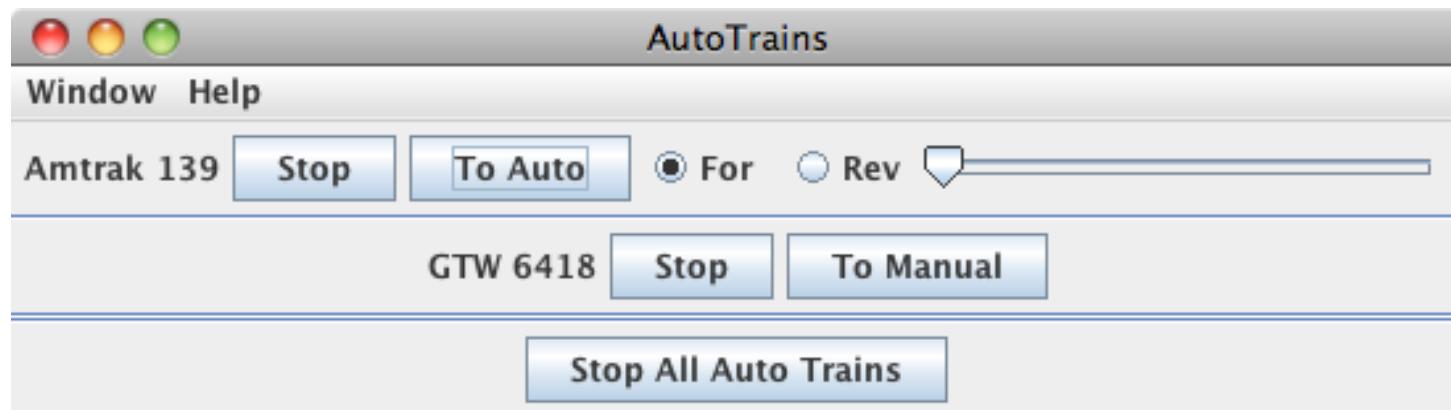
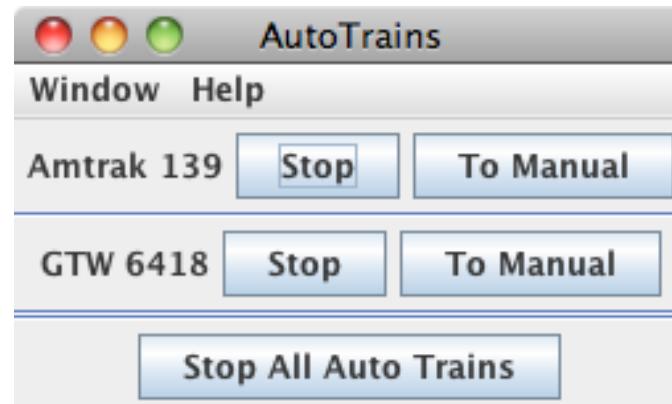
Cancel Add New Train



Auto Trains Window

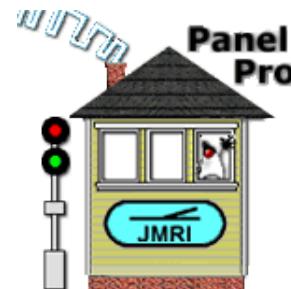


Click "To Manual"
for Amtrak 139





Example: Setting up Automatic Actions for a Station Stop

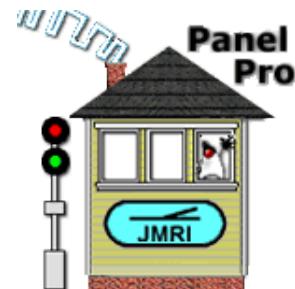


Transit Table						
System Name	User Name	State	Comment			
IZ1	Red Main Loop	ASSIGNED		Delete	Edit	Duplicate
IZ1A	Red Main LoopA	IDLE		Delete	Edit	Duplicate
IZ1B	Red Main LoopB	IDLE		Delete	Edit	Duplicate
IZ2	Staging-Kaylaville Loop	IDLE		Delete	Edit	Duplicate
IZ3	Amtrak-East Bound	IDLE		Delete	Edit	Duplicate
IZ4	Amtrak-West Bound	IDLE		Delete	Edit	Duplicate
IZ5	Red Main Loop CW	IDLE		Delete	Edit	Duplicate
IZ6	Blue Main Loop CW	ASSIGNED		Delete	Edit	Duplicate
IZ7	Blue Main Loop CCW	IDLE		Delete	Edit	Duplicate

Click “Edit” for the “Amtrack-East Bound” Transit (from the T&K Railroad).



Example: Setting up Automatic Actions for a Station Stop (continued)



Click “View/Add/Edit Actions” for 18 – Blue Main 8.

Add/Edit Transit

Window Help

System Name: IZ3 User Name: Amtrak-East Bound

Sections in Transit (at least 2 are required)

Order	Section	Actions	Direction	Alternate
15	IY20(Blue Main 5_4)	View/Add/Edit Actions	REVERSE	Primary
16	IY19(Blue Main 6)	View/Add/Edit Actions	REVERSE	Primary
17	IY18(Blue Main 7)	View/Add/Edit Actions	REVERSE	Primary
18	IY17(Blue Main 8)	View/Add/Edit Actions	REVERSE	Primary
19	IY16(Blue Main 3)	View/Add/Edit Actions	REVERSE	Primary
20	IY15(Blue Main 2)	View/Add/Edit Actions	REVERSE	Primary

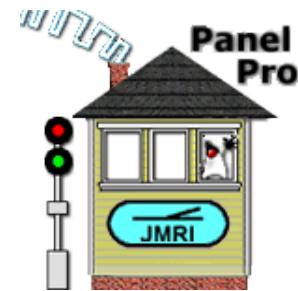
[Delete All Sections](#) IY24(Staging South Feeder) ▾ [Add Next Section](#)

◀ ▾ [Add Alternate Section](#)

[Cancel](#) [Update](#)



Example: Setting up Automatic Actions for a Station Stop (continued)



Click “Add New Action”.

View Actions

Window Help

Section: IY17(Blue Main 8) Sequence: 18

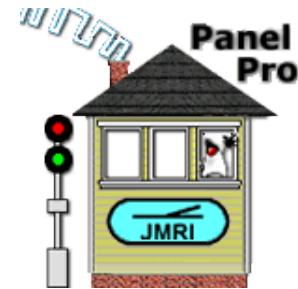
When	Action Requested	
------	------------------	--

Add New Action Done

View Actions Window



Example: Setting up Automatic Actions for a Station Stop (continued)



Add/Edit Action Window

When →

Add/Edit Action

Window Help

When: On Section Entry

Optional Delay: (milliseconds)

What: Start Bell

Create New Action Cancel

What →

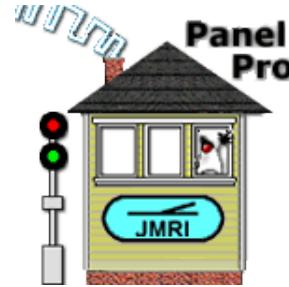


When

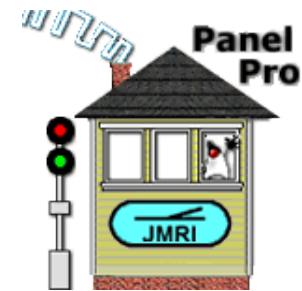
- On Section Entry
- On Section Exit
- On Block Entry
- On Block Exit
- On Train Stop
- On Train Start
- On Sensor ACTIVE
- On Sensor INACTIVE

Note: An Action may be delayed for
a user-specified time after the When.

What



- Pause Train
- Set Maximum Speed
- Set Train Speed
- Ramp Train Speed
- Go to Manual Mode
- Set Locomotive Light
- Start Bell
- Stop Bell
- Sound Horn
- Pattern Sound Horn
- Set Decoder Function
- Set Sensor ACTIVE
- Set Sensor INACTIVE



Example: Setting up Automatic Actions for a Station Stop (continued)

View Actions

Window Help

Section: IY17(Blue Main 8) Sequence: 18

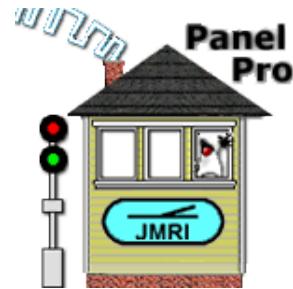
When	Action Requested		
On entry to this Section	Start bell (if sound decoder)	Edit	Delete

Add New Action Done

Continue to use “Add New Action” to add more automatic Actions.



Example: Setting up Automatic Actions for a Station Stop (continued)



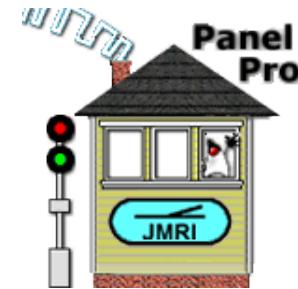
View Actions

Window Help

Section: IY17(Blue Main 8) Sequence: 18

When	Action Requested	Edit	Delete
On entry to this Section	Start bell (if sound decoder)	Edit	Delete
When train stops moving	Stop bell (if sound decoder)	Edit	Delete
"4000" ms. after entering this Section	Pause for "10" fast minutes	Edit	Delete
When train starts moving	Start bell (if sound decoder)	Edit	Delete
On Exit from this Section	Stop bell (if sound decoder)	Edit	Delete
When train starts moving	Sound horn for "1,000" ms.	Edit	Delete

Add New Action Done



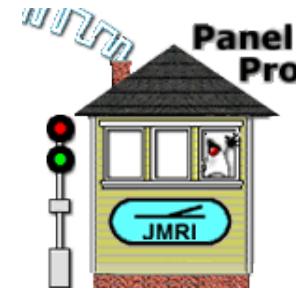
Switching Example:

- Automatically drive an Active Train to a switching location.
- Turn over the train to a human engineer for switching.
- Resume automatic operation when switching is complete.

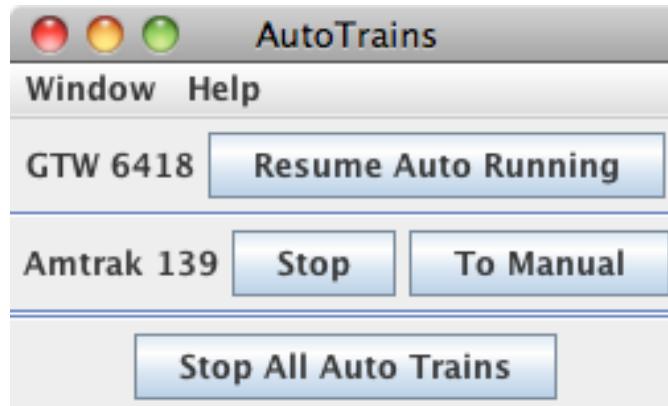
Set the **“Go to Manual Mode”** Action in the Section where the switching is to occur.



Switching Example: (continued)



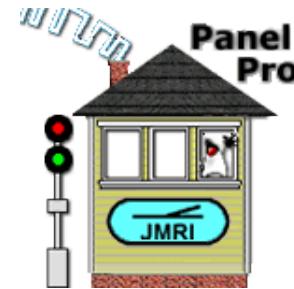
- When the “Go to Manual Mode” Action takes place, the computer releases its throttle.
- The entry for the Auto Active Train (GTW 6418) changes to:



- The dispatcher notifies the human engineer that he/she may acquire the engine and switch train cars.
- When the dispatcher is notified that switching is complete, the dispatcher clicks “Resume Auto Running”.



Requirements for Manual Running (Human Engineer)



Required:

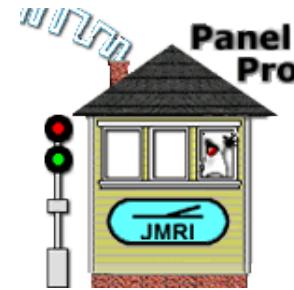
- Layout must be divided into **Blocks**.
- Blocks (including Paths) must be set up.
- **Sections** and **Transits** must be set up.

Recommended:

- Hardware **Block Occupancy Detection**. Required for **Auto Release**.
- Fully detectable trains – usually means **Resistance Wheels** on all train cars, to facilitate stopping trains. Required for **Auto Release**.
- **Computer-controlled Turnouts** (track switches). Required for automatic setting of Turnouts when Sections are allocated.
- Fully configured **Layout Editor Panel**. Required for automatic setting of Turnouts when Sections are allocated. Greatly facilitates the setting up Sections and Transits.
- **Well functioning layout** – most important for successful manual running.



Requirements for Automatic Running (Virtual Engineer)



Required:

- DCC Command Station that supports **JMRI Computer Throttles**.
- Layout Mainline must be divided into **Blocks** with **Occupancy Detection** hardware.
- **Turnouts** (track switches) along mainline must be capable of computer control.
- **Layout Editor Panel**, with Blocks, Turnouts, and Signals fully configured. All Block boundaries must be signaled on the Layout Editor panel.

Note: Signals must be configured on the Layout Editor panel, but physical signals need not be present.

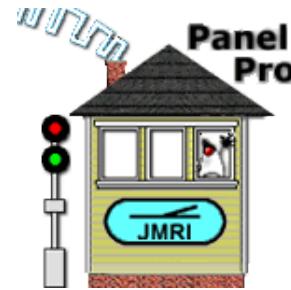
- **Sections** and **Transits** must be set up.
- All Sections must have **Direction Sensors**.

Recommended:

- **Stop Sensors** in areas where accurate stopping is desired.
- **Block Lengths** entered into Block table, to facilitate stopping.
- Fully detectable trains – usually means **Resistance Wheels** on all train cars, to facilitate stopping trains. Required for **Auto Release**.
- **Well functioning layout** – most important for successful automatic running.

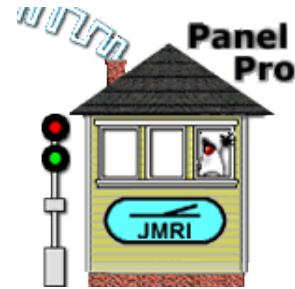


What's Next?



Dispatcher Development is continuing.

- Better validation of Sections and Transits.
- Improved protection/recovery from human dispatcher error.
- More automatic Section Allocation options.
- Improved Transit creation/editing.
- More robust Automatic Running?
- ??? User suggestions.



This clinic is available as a PDF file:

DispatcherClinic2010.pdf

To run the demo, view the tables and the Logixs that simulates train running, you also need:

Dispatcher2010.xml