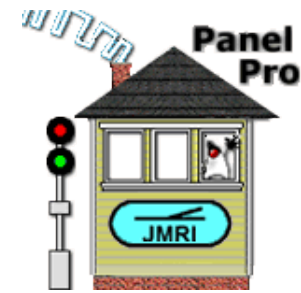


Running Trains with JMRI's Dispatcher

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.

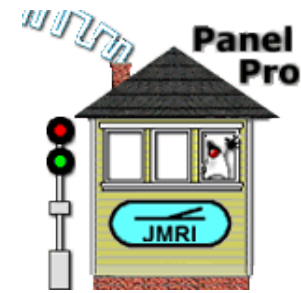
Dispatcher is **not** designed to be prototypical, and **not** designed to replace a human dispatcher.

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.

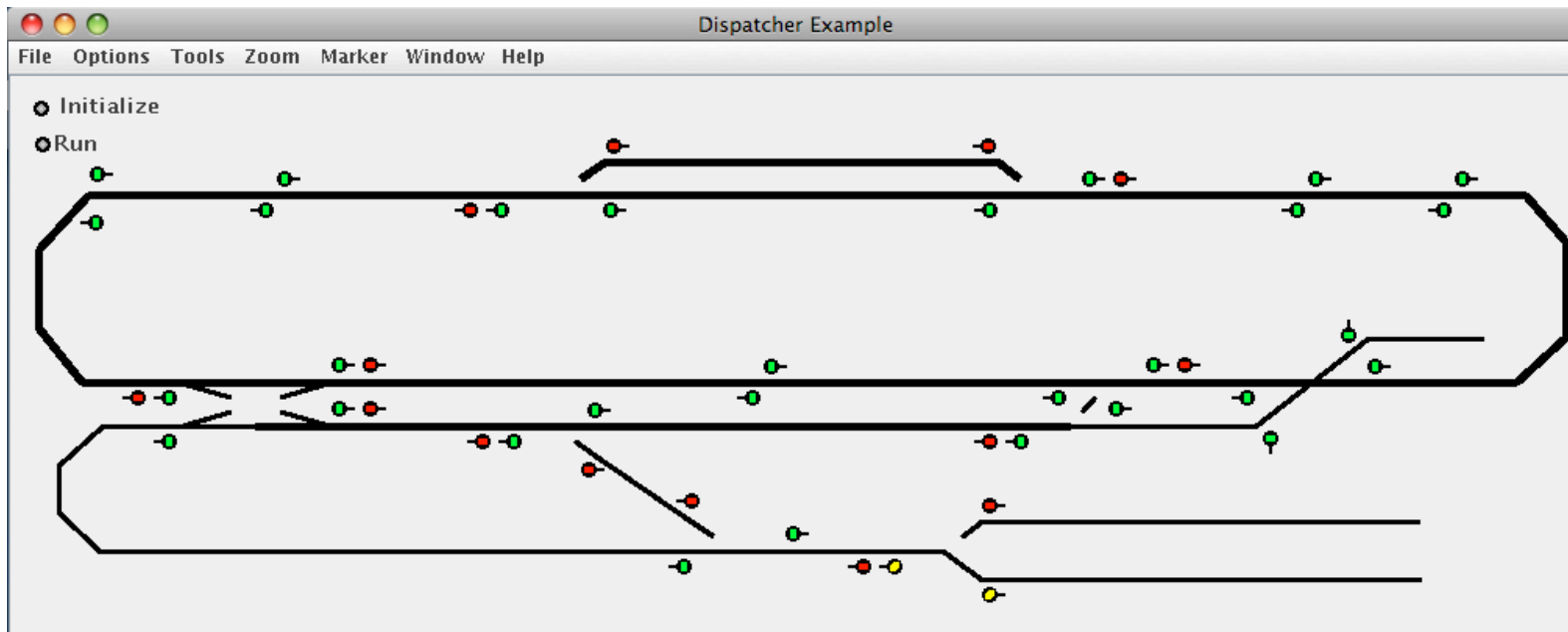
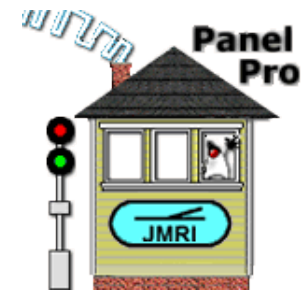
Dispatcher requires that **Sections** (and **Transits**) be set up before running trains that use them.

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



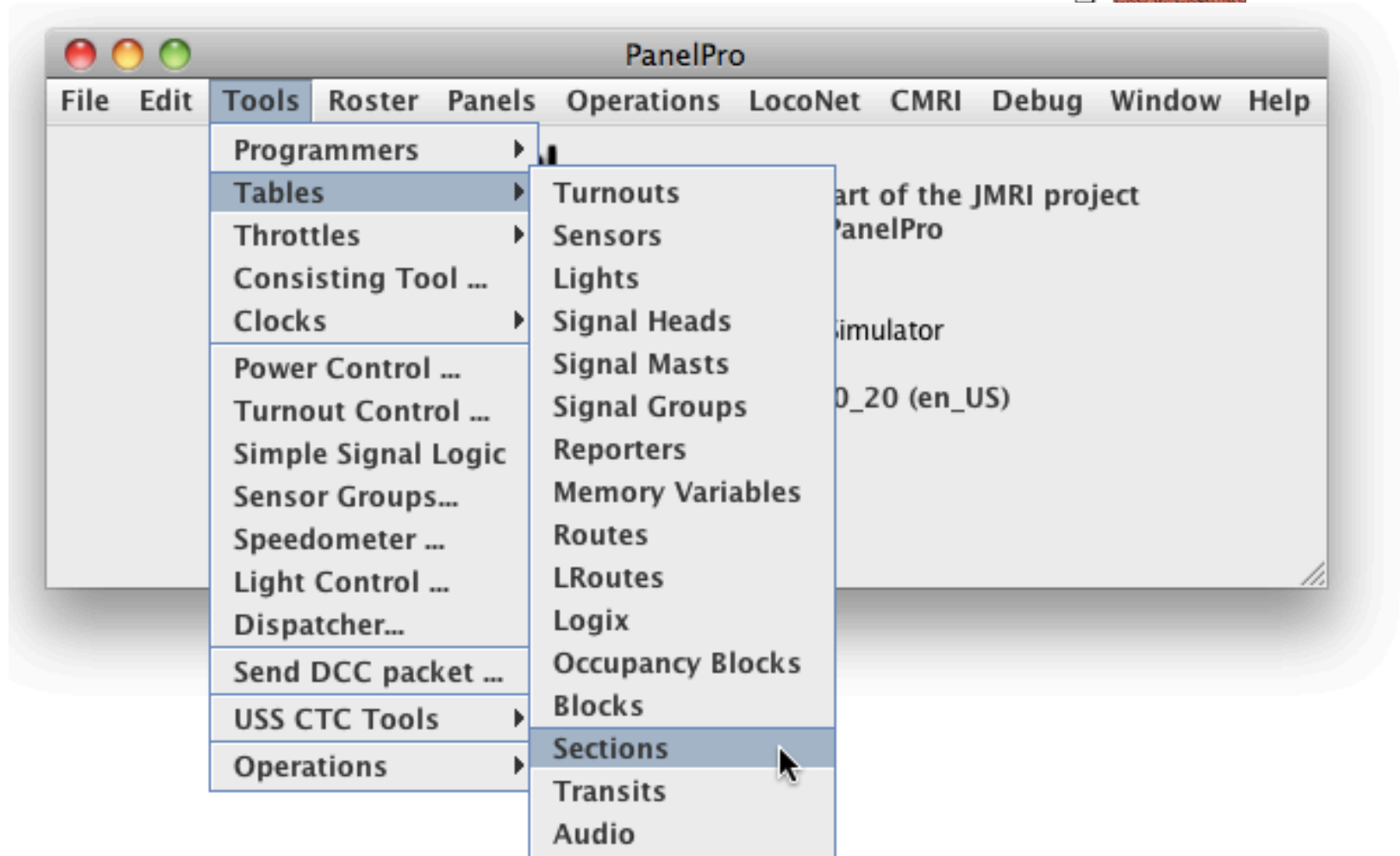
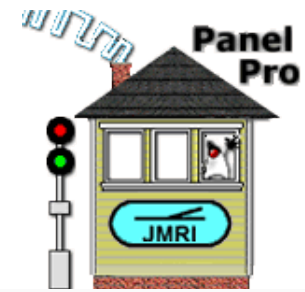
Demo Layout

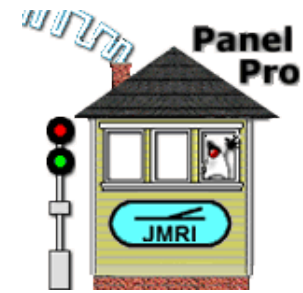
(Made with Layout Editor)





Set up Sections using the **Section Table**





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

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

Add ...



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.

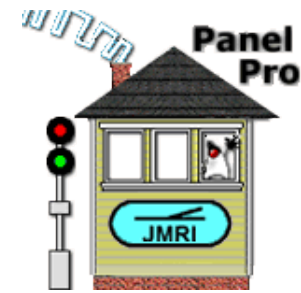
Direction Sensors (Optional)

Forward Sensor: IS65 Reverse Sensor: IS66

Stopping Sensors (Optional)

Forward Stopping Sensor: Reverse Stopping Sensor:

Cancel Update



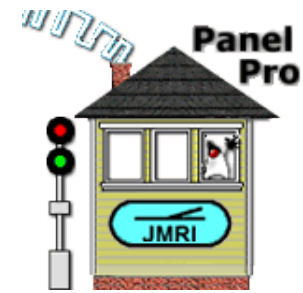
What are Direction Sensors?

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.

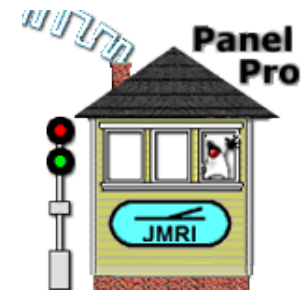
Section Table

File Window Help **Tools**

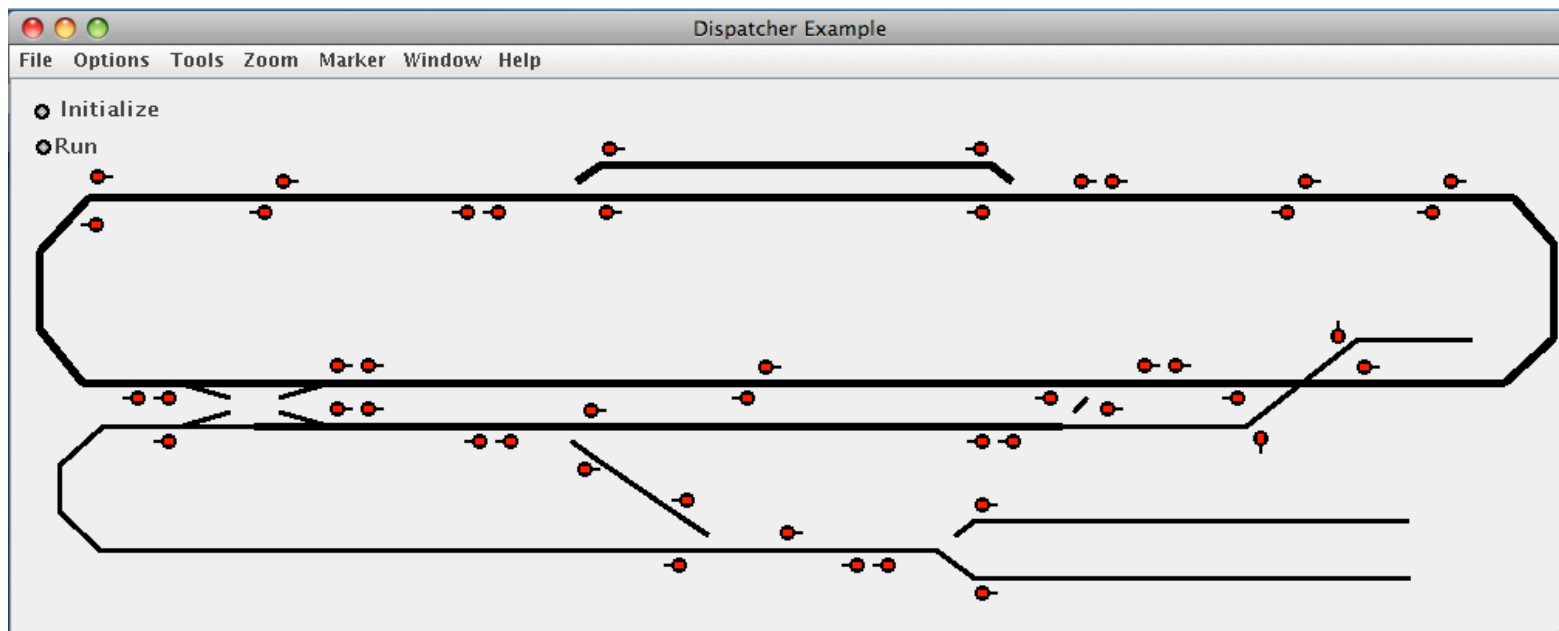
Validate All Sections...
Set Direction Sensors in Logic...
Remove Direction Sensors from Logic...

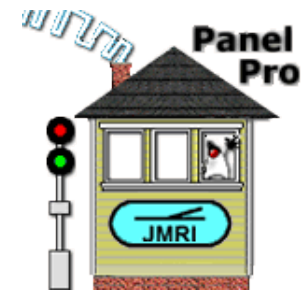
System ...	User Name				First Block	Last Block	
IY1	1234				IB2(Block1)	IB4(Block4)	Edit
IY10	Staging Access				IB15(Staging Access 1)	IB15(Staging Access 1)	Edit
IY11	Staging Alt	FREE		Delete	IB16(Staging Access 2)	IB16(Staging Access 2)	Edit
IY2	5	FREE		Delete	IB5(Block5)	IB5(Block5)	Edit
IY3	6	FREE		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

Add ...



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



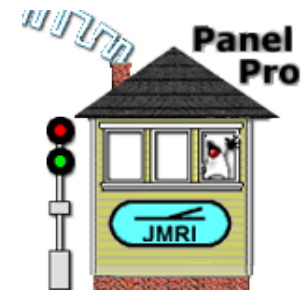


What is a Transit?

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.

The screenshot shows a window titled "Transit Table" with a menu bar containing "File", "Window", and "Help". The window contains a table with the following data:

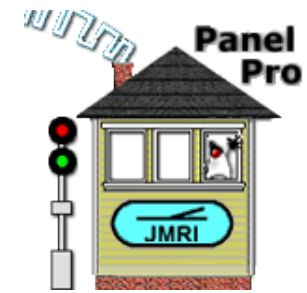
System N...	User Name	State	Comment			
I211	clockwise	IDLE		Delete	Edit	Duplicate
I212	counter-clockwise	IDLE		Delete	Edit	Duplicate

Below the table is a scrollable area and a button labeled "Add ...".



“Clockwise” Transit

Note alternate Sections at siding.



Add/Edit Transit

Window Help

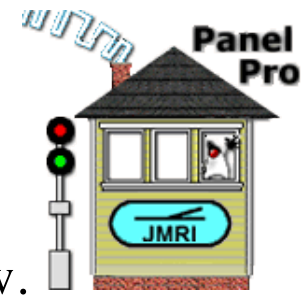
System Name: IZ11 User Name:

Sections in Transit (at least 2 are required)

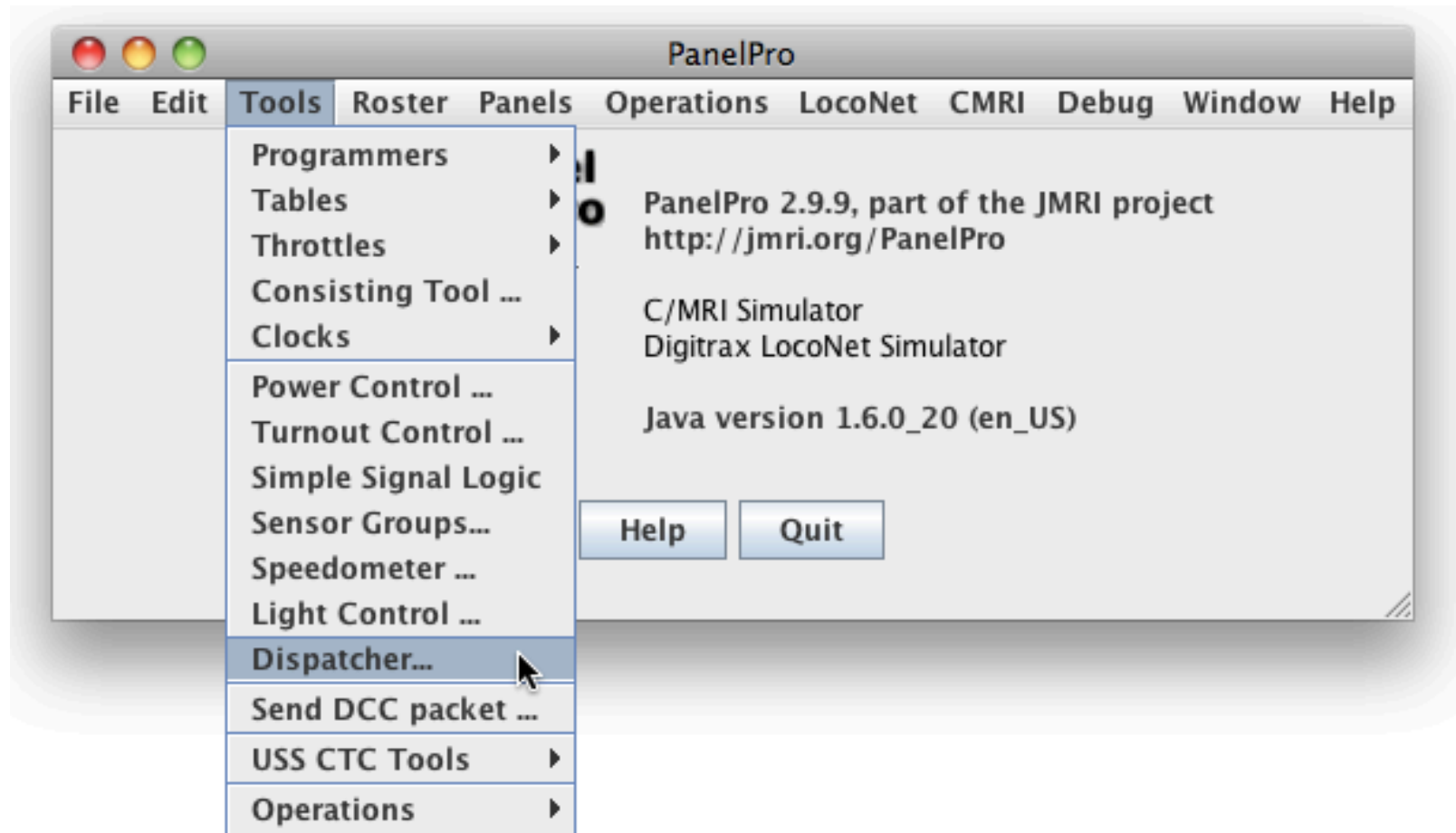
Order	Section	Actions	Direction	Alternate
1	IY6(Staging 1)	View/Add/Edit Actions	FORWARD	Primary
2	IY10(Staging Access)	View/Add/Edit Actions	FORWARD	Primary
3	IY9(Lower Main)	View/Add/Edit Actions	REVERSE	Primary
4	IY1(1234)	View/Add/Edit Actions	FORWARD	Primary
5	IY2(5)	View/Add/Edit Actions	REVERSE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



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

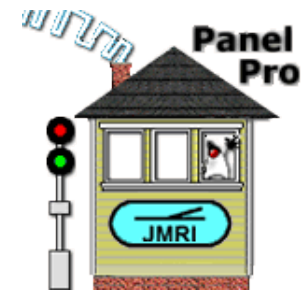


Select **“Dispatcher...”** in the main PanelPro window.





The dispatcher controls the layout via the
Dispatcher Window.



Three Tables:

Active Trains

Requested
Allocations

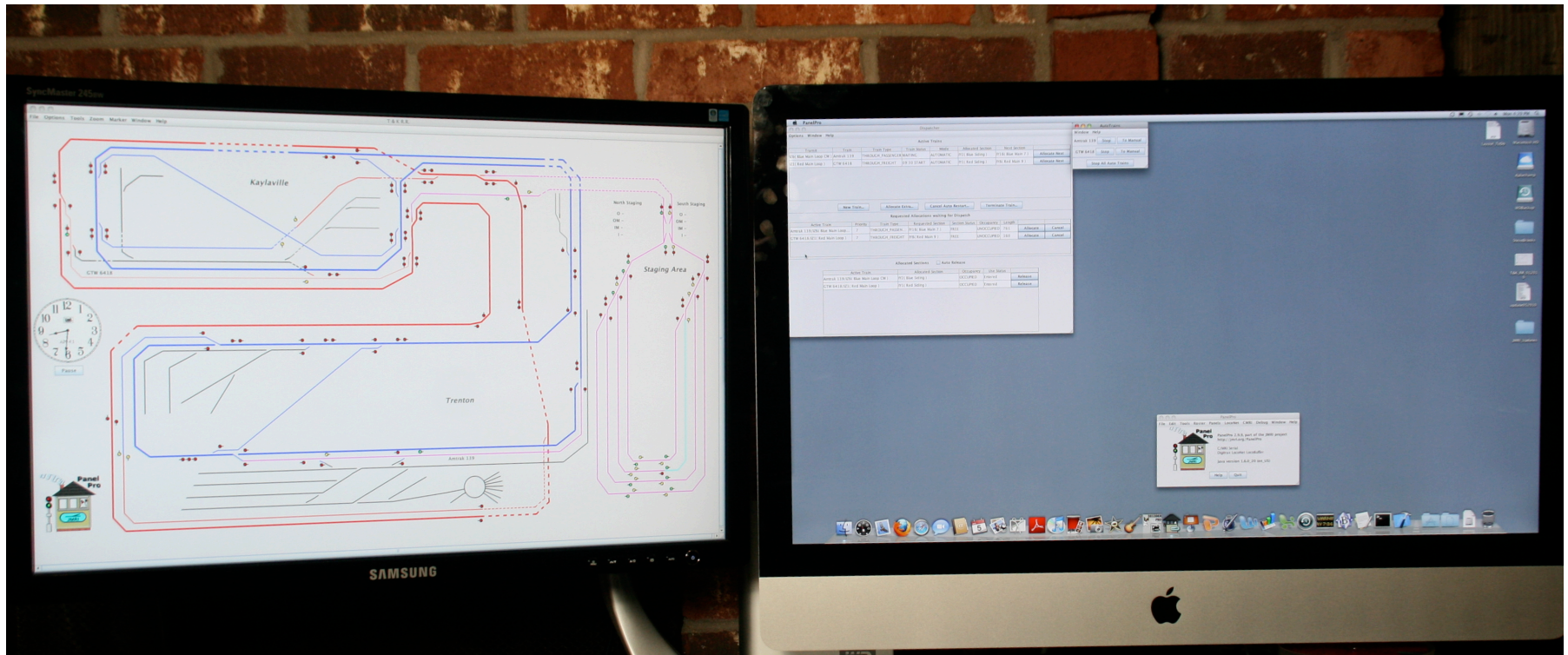
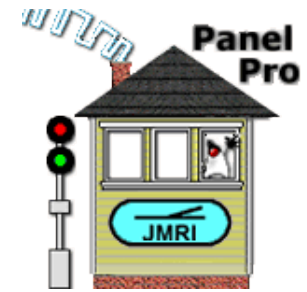
Allocated
Sections

The screenshot shows the 'Dispatcher' window with a menu bar (Options, Window, Help) and three main sections:

- Active Trains:** A table with columns: Transit, Train, Train Type, Train Status, Mode, Allocated Section, Next Section. Below the table are buttons: 'New Train...', 'Allocate Extra...', 'Cancel Auto Restart...', and 'Terminate Train...'.
- Requested Allocations waiting for Dispatch:** A table with columns: Active Train, Priority, Train Type, Requested Section, Section Status, Occupancy, Length.
- Allocated Sections:** A table with columns: Active Train, Allocated Section, Occupancy, Use Status. A checkbox labeled 'Auto Release' is located above the table.

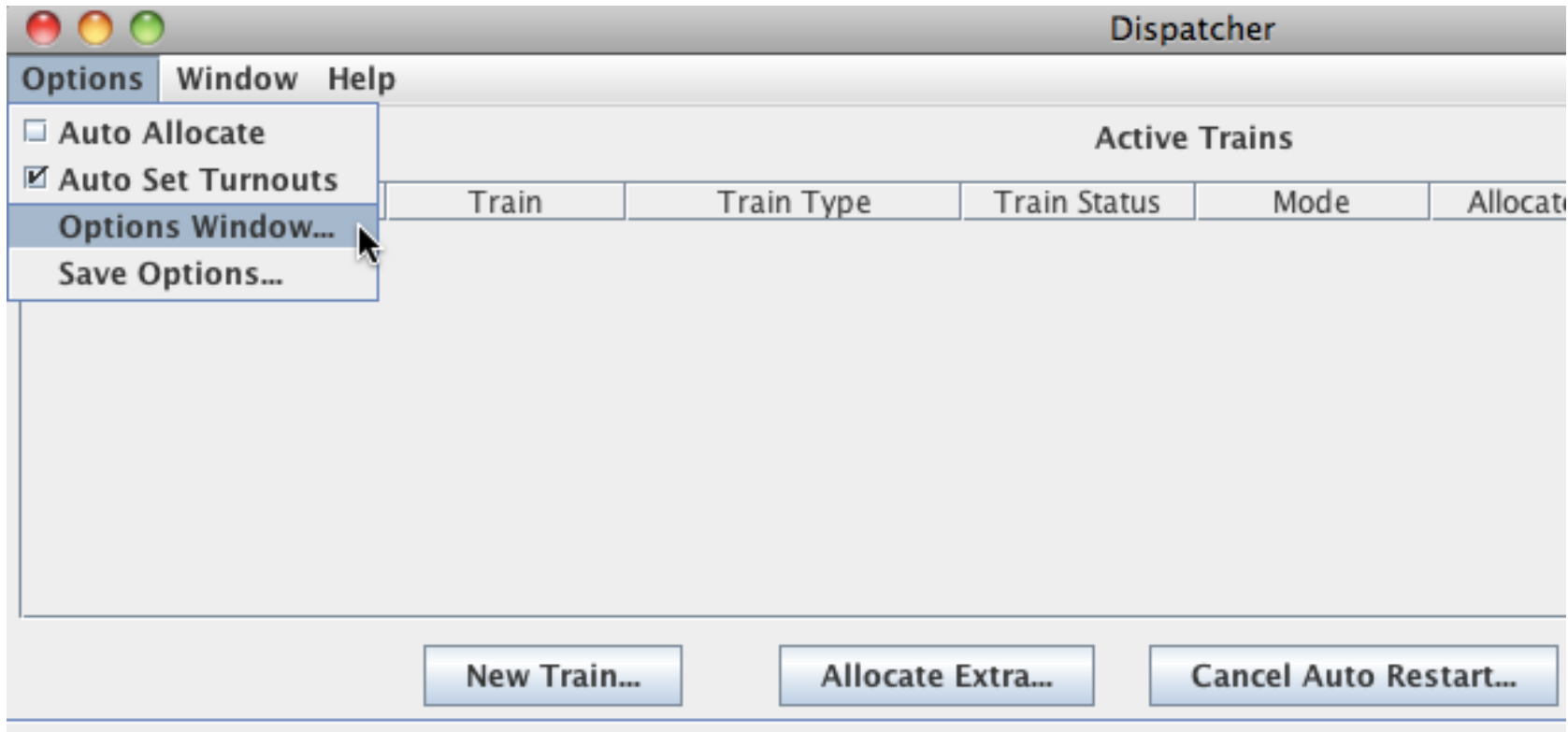
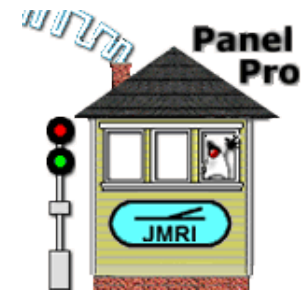


Dispatcher Window is large. Works best with multiple monitors, but multiple monitors are not required.





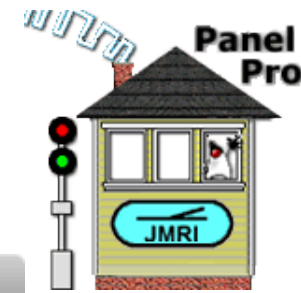
Click **“Options Window...”** in the Dispatcher **“Options”** menu.





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

Cancel Apply

Note:

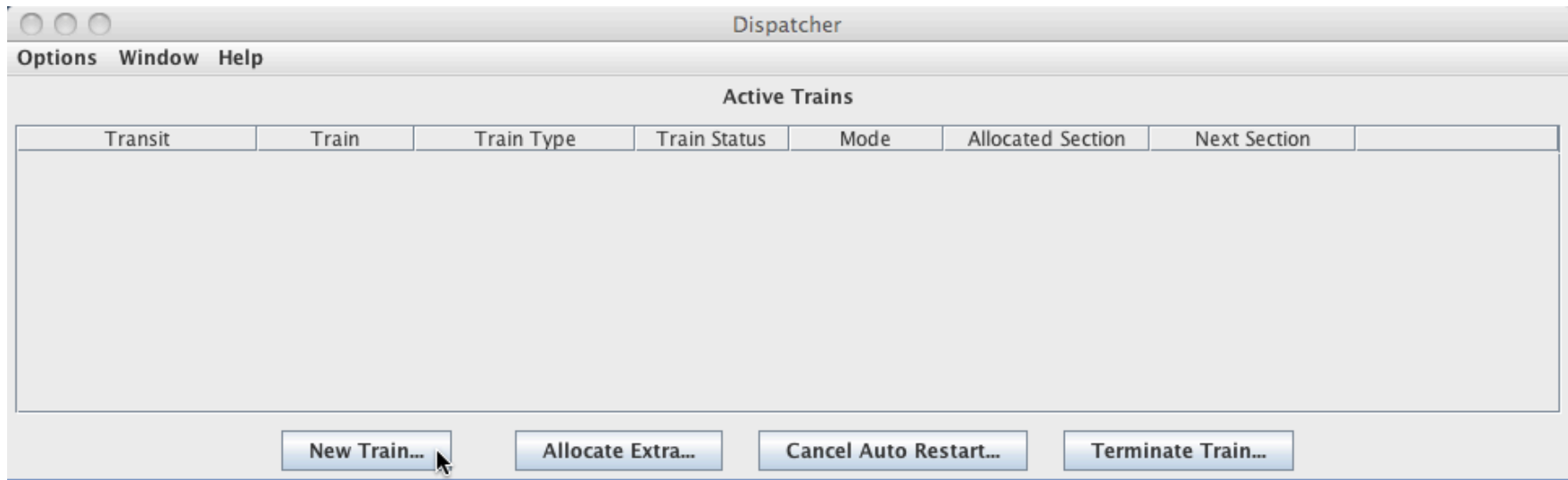
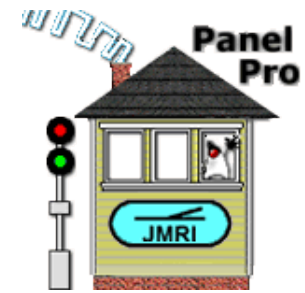
To save these Options and have them automatically set when restarting, select

Save Options...

in Dispatcher's Option menu.



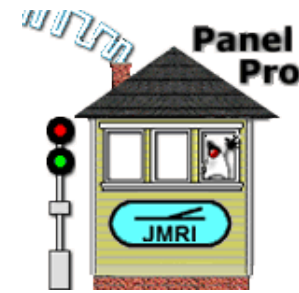
To create an **Active Train**, ready to be dispatched, click **“New Train...”** below the Active Trains table.





Activate New Train Window

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



Activate New Train

Window Help

Load Train Info Save Train Info

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

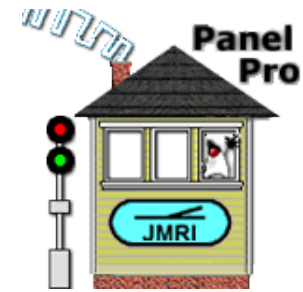
Cancel Add New Train

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	
IZ11(clockwise)	BNSF7665	LOCAL_FREIGHT	RUNNING	DISPATCHED	IY9(Lower Main)	IY1(1234)	Allocate Next

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

Requested Allocations waiting for Dispatch

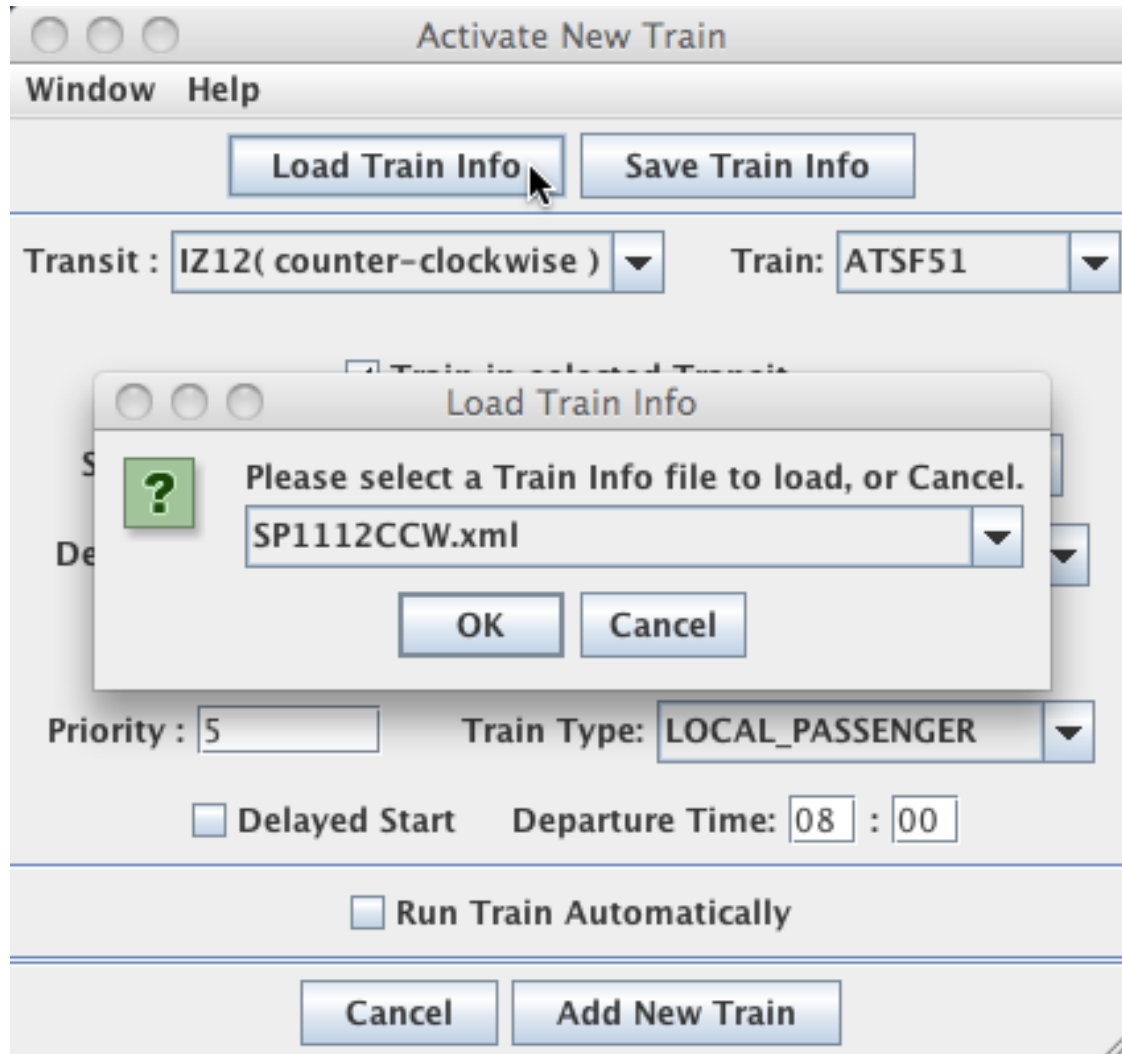
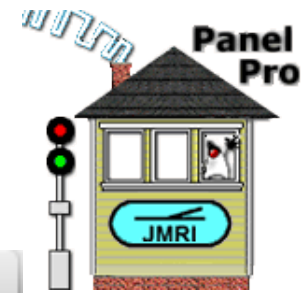
Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length		
--------------	----------	------------	-------------------	----------------	-----------	--------	--	--

Allocated Sections Auto Release

Active Train	Allocated Section	Occupancy	Use Status	
BNSF7665 / IZ11(clockwise)	IY6(Staging 1)	OCCUPIED	Entered	Release
BNSF7665 / IZ11(clockwise)	IY10(Staging Access)	UNOCCUPIED	Not Entered	Release
BNSF7665 / IZ11(clockwise)	IY9(Lower Main)	UNOCCUPIED	Not Entered	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-clockwis...	SP1112	THROUGH_FREIGHT	WAITING	DISPATCHED	IY7(Staging 2)	IY10(Staging Acces...	Allocate Next

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

Requested Allocations waiting for Dispatch

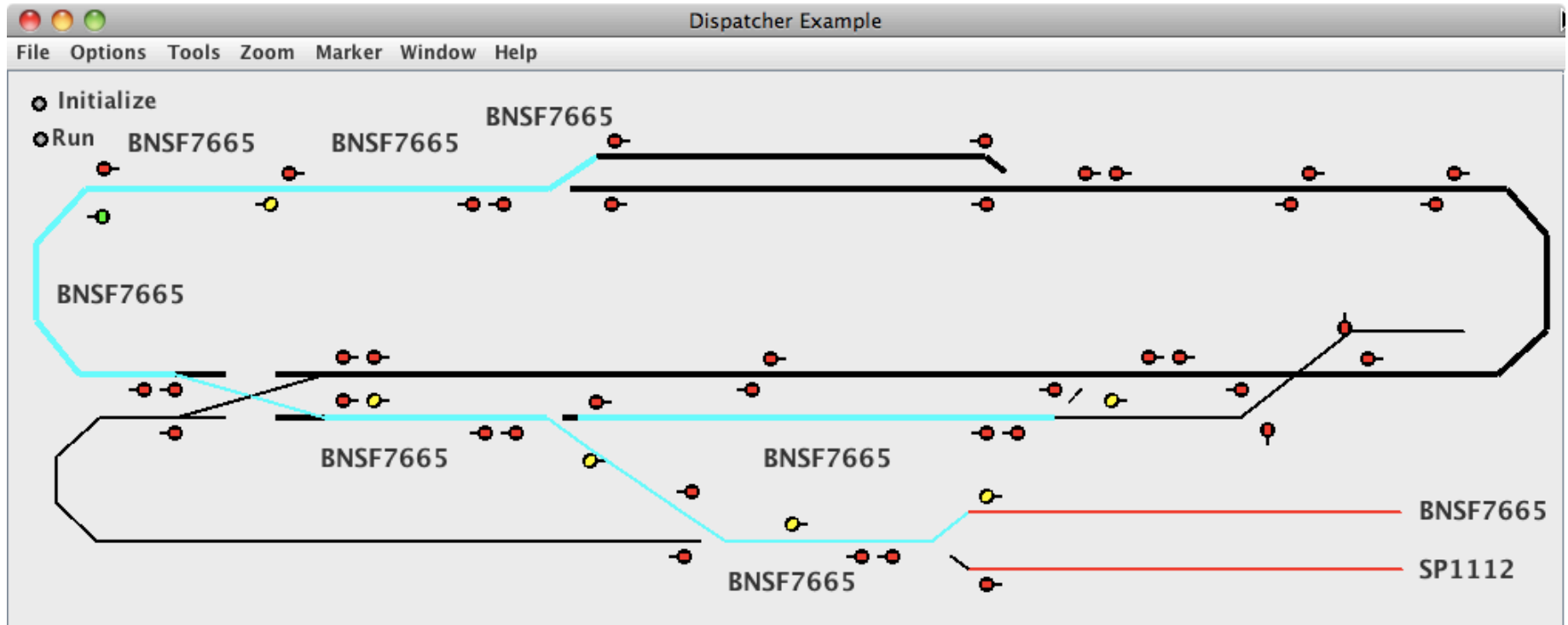
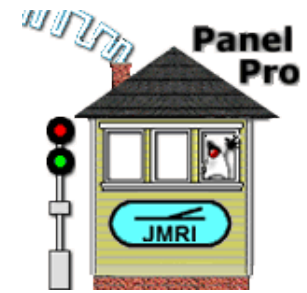
Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length		
SP1112/IZ12(counter-clockwise)	5	THROUGH_FREIGHT	IY10(Staging Access)	ALLOCATED	UNOCCUPIED	0	Allocate	Cancel

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

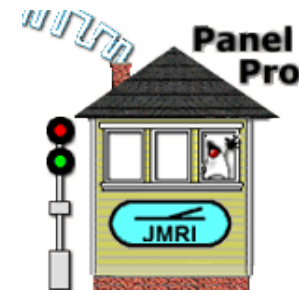


Demo Layout





Active Trains Table



Dispatcher

Options Window Help

Active Trains

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

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

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

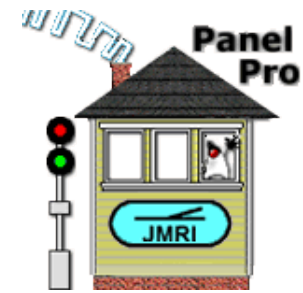
Allocate Extra... - Click to allocate a Section to an Active Train that is not the next Section in the Transit.

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



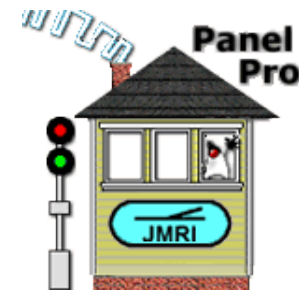
Requested Allocations waiting for Dispatch

Active Train	Priority	Train Type	Requested Section	Section Status	Occupancy	Length		
SP1112 / IZ12 (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

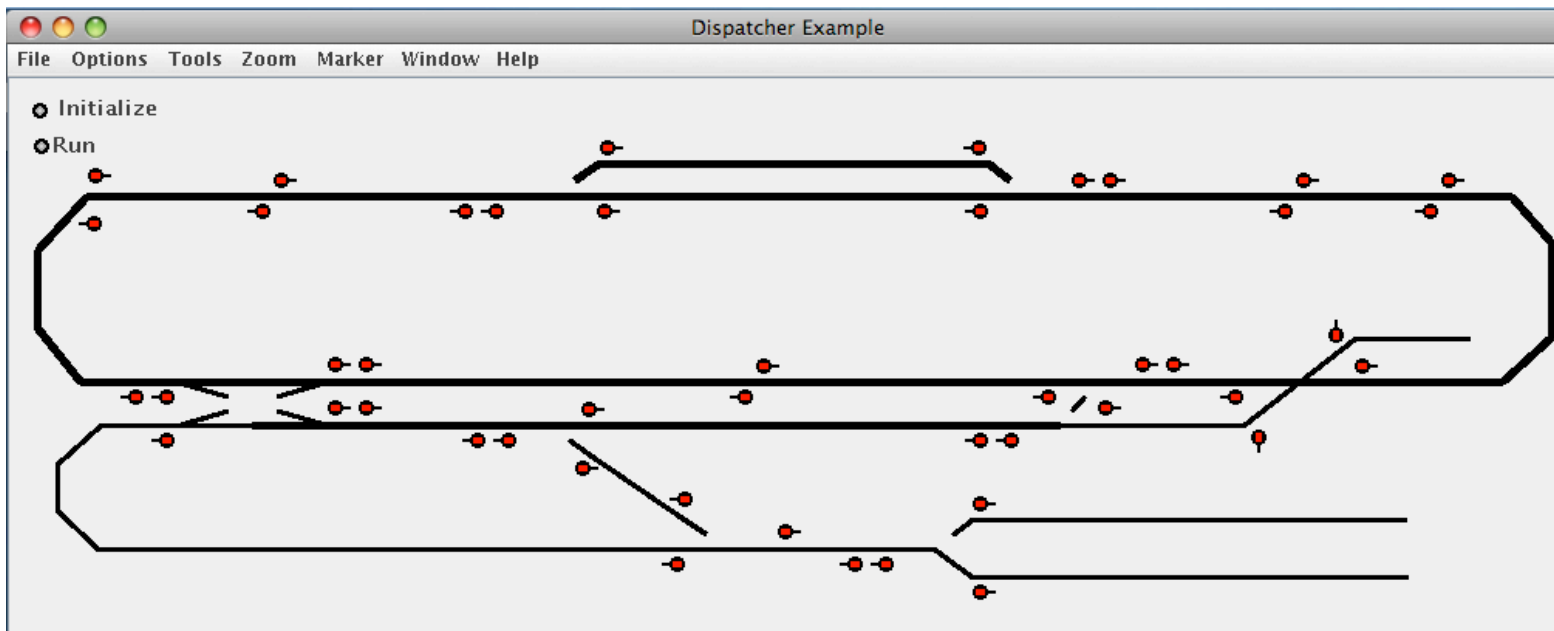
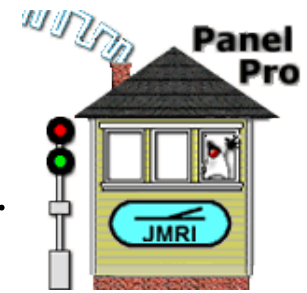
Checking “**Auto Release**” will automatically release Allocated Sections when **Occupancy** shows **UNOCCUPIED** and **Use Status** shows **Exited** (Allocated Section has been Entered and Exited.)



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

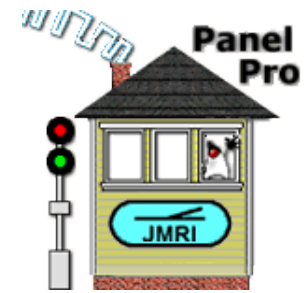
Loco has sound decoder. Run in reverse

All cars have resistance wheels Maximum Train Length: 112.0

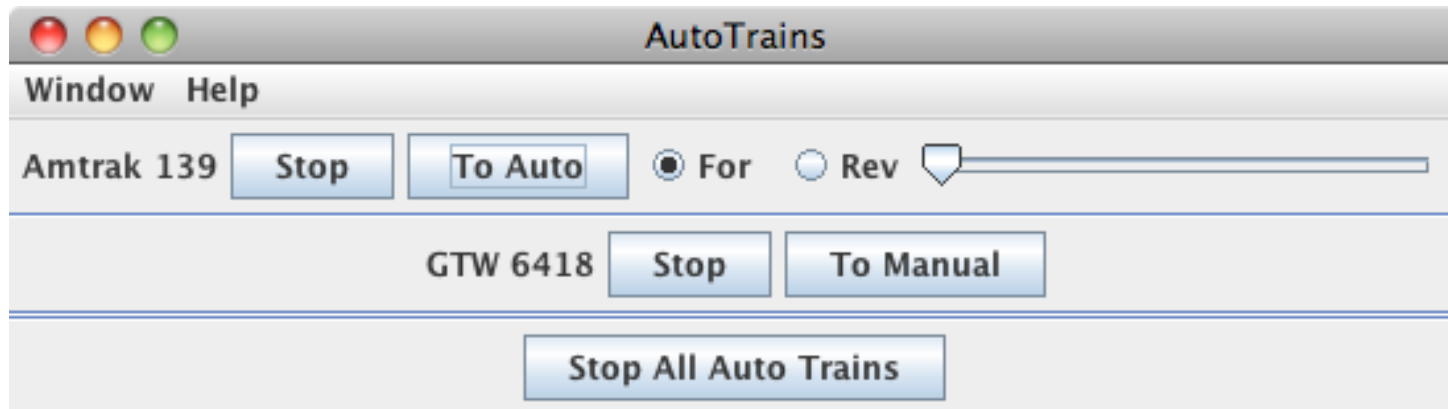
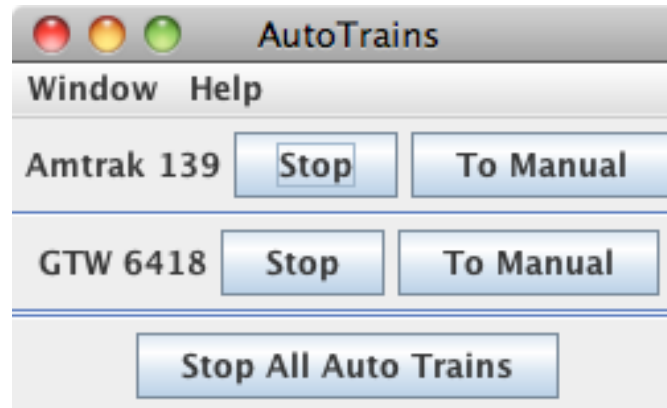
Cancel Add New Train



Auto Trains Window

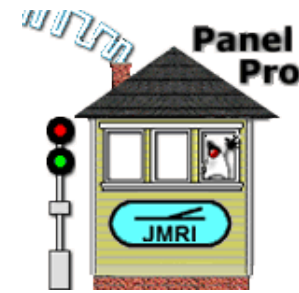


Click “To Manual”
for Amtrak 139





Example: Setting up Automatic Actions for a Station Stop



Transit Table

File Window Help

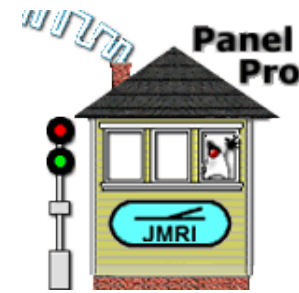
System Name ^	User Name	State	Comment			
IZ1	Red Main Loop	ASSIGNED		Delete	Edit	Duplicate
IZ1A	Red Main LoopA	IDLE		Delete	Edit	Duplicate
IZ1B	Red Main LoopB	IDLE		Delete	Edit	Duplicate
IZ2	Staging-Kaylville Loop	IDLE		Delete	Edit	Duplicate
IZ3	Amtrak-East Bound	IDLE		Delete	Edit	Duplicate
IZ4	Amtrak-West 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

Add ...

Click “Edit” for the “Amtrak-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.

Window Help

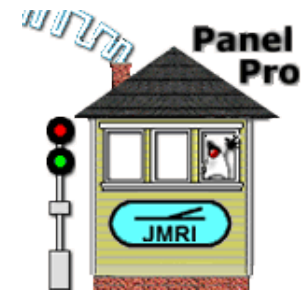
System Name: IZ3 User Name:

Sections in Transit (at least 2 are required)

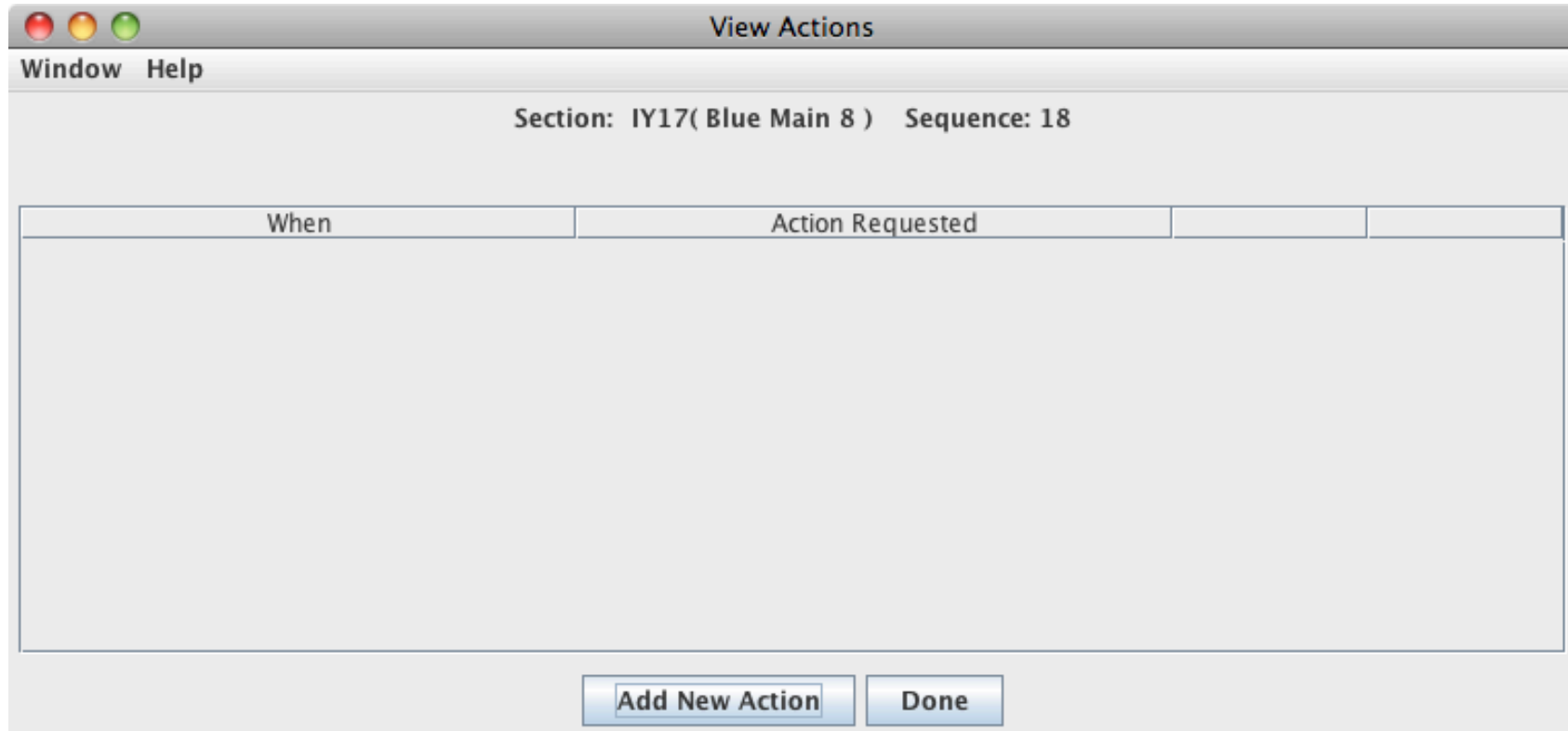
Order	Section	Actions	Direction	Alternate
15	IY20(Blue Main 5_4)	View/Add/Edit Actions	REVERSE	Primary
16	IY19(Blue Main 6)	View/Add/Edit Actions	REVERSE	Primary
17	IY18(Blue Main 7)	View/Add/Edit Actions	REVERSE	Primary
18	IY17(Blue Main 8)	View/Add/Edit Actions	REVERSE	Primary
19	IY16(Blue Main 3)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



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



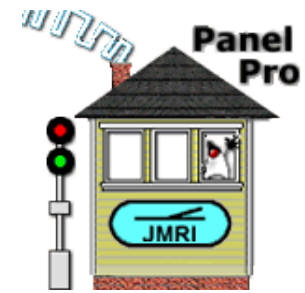
Click “Add New Action”.



View Actions Window



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



Add/Edit Action Window

When →

A screenshot of the "Add/Edit Action" dialog box in the JMRI software. The dialog has a title bar with three colored buttons (red, yellow, green) and the text "Add/Edit Action". Below the title bar are "Window" and "Help" menus. The main area contains a "When:" label followed by a dropdown menu showing "On Section Entry". Below this is an "Optional Delay:" label followed by an empty text input field and the text "(milliseconds)". The "What:" label is followed by a dropdown menu showing "Start Bell". At the bottom of the dialog are two buttons: "Create New Action" and "Cancel".

What →



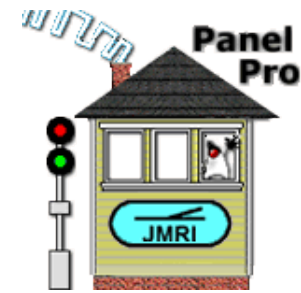
When

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.

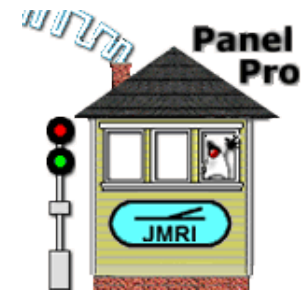
What

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

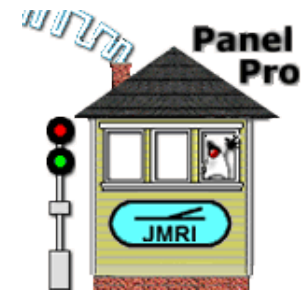
When	Action Requested		
On entry to this Section	Start bell (if sound decoder)	Edit	Delete

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)



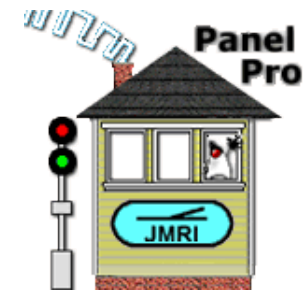
View Actions

Window Help

Section: IY17(Blue Main 8) Sequence: 18

When	Action Requested		
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



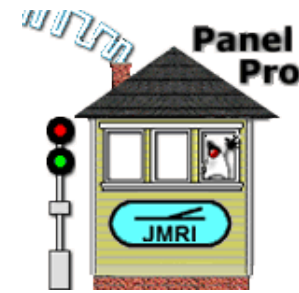
Switching Example:

- 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.

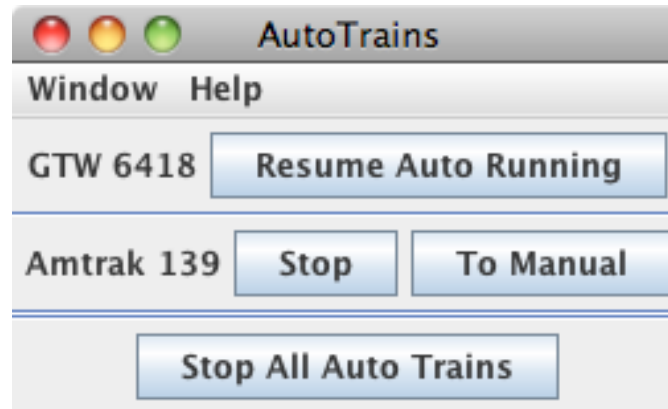
Set the **“Go to Manual Mode”** Action in the Section where the switching is to occur.



Switching Example: (continued)



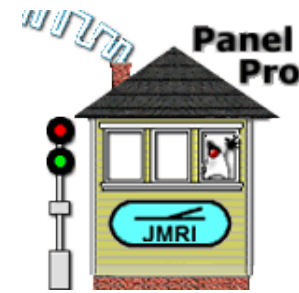
- When the “Go to Manual Mode” Action takes place, the computer releases its throttle.
- The entry for the Auto Active Train (GTW 6418) changes to:



- 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:

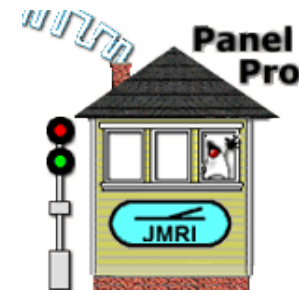
- Layout must be divided into **Blocks**.
- Blocks (including Paths) must be set up.
- **Sections** and **Transits** must be set up.

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.

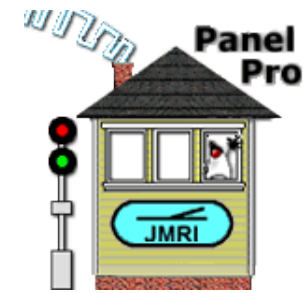
- **Sections** and **Transits** must be set up.
- All Sections must have **Direction Sensors**.

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.

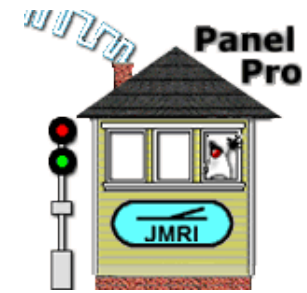


What's Next?



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