# MiniRail Solutions

# Signal System Monitoring & Control
# "SComm"

# User Manual

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# Table of Revisions

2016-11-29    Initial creation

2016-11-30    Expanded Overview and "Quick Tour" sections

2016-12-01    Added "Layout File Format (Track Definition File)" section

2016-12-01    Minor corrections

2016-12-02    Changed Track Switch "Properties" dialog box

2016-12-03    Spelling/typo corrections

2016-12-02    Changed Signal Head "Properties" dialog box

2017-07-09    Fixed minor typos

2017-12-22    Updated the property dialogs for Signals and Track Switch objects (SComm now supports vertical track switches)

2022-06-07    Removed "MiniRailNet.dll – Building Your Own Monitoring and Control Tools"

2022-06-07    Added "Web Server Support"

# Table of Contents

# 1   Overview

*(Note: This is a work in progress.  My purpose here is to give you enough information to evaluate SComm and get an idea of what it can do – more like a "Help" file for SComm.  More detailed information will be provided in future releases.)*

SComm is a Windows-based program supplied free of charge with the MiniRail System hardware.

SComm is used to configure, monitor, and control the MiniRail network (See the "BC002 Signal Controller User Manual" for more information about the MiniRail network and controllers).

SComm connects to any BC002 controller on the network via a USB-to-Serial cable.  This cable can be connected to the Diagnostics Port on any controller.  This allows SComm to monitor the entire system from any controller location.

Using a laptop, SComm can be connected to a controller in the field to monitor/diagnose signal problems (typically broken wires from a track, broken bond wires, etc.) or it can be connected to a dedicated controller for use by a dispatcher or to display traffic to people waiting in the loading area, etc.

Because all controllers are connected to the same data bus SComm has access to all of the data available on the bus, track status, switch positions, signal head aspects, etc.

A future version will allow the track status to be made available on your web site so people can see a real-time display of train movements.  Because the display is then web-based, engineers will be able to access the display real-time track status on any wirelessly connected Smart Phone, Tablet, IPad, etc.


# 2   Running SComm

When you first start SComm you will be presented with a blank Track Display and a copy of the Release Notes:
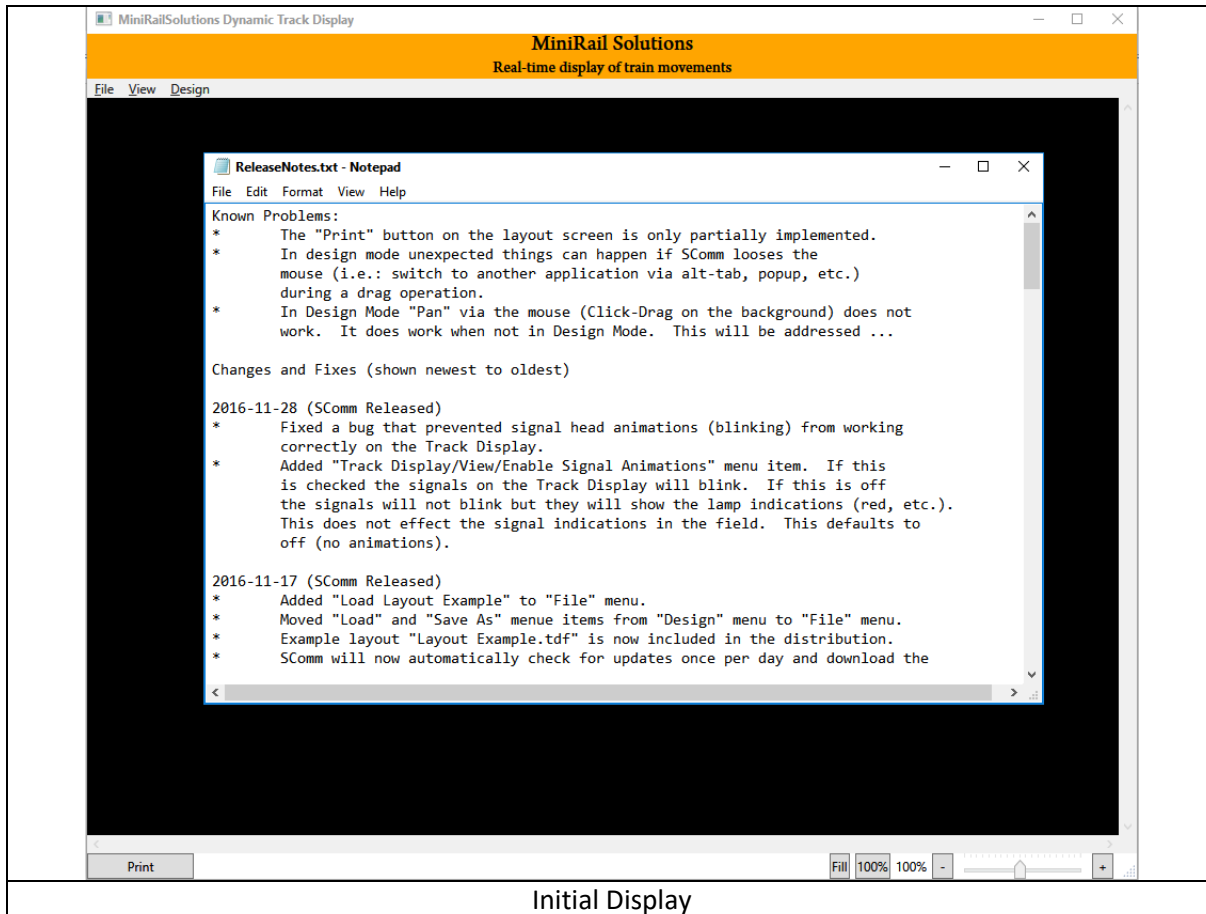
Initial Display

The Release Notes will be displayed once automatically whenever a new version of SComm is installed. SComm only displays the Release Notes file if its timestamp has changed from the last time SComm was run.  You can find the "ReleaseNotes.txt" file in the installation folder.

After viewing the Release Notes, you can close the window using the "X" in the upper-right corner of the Notepad window.

## 3   A Quick Tour

Start SComm and, if it opens, close the "Release Notes" file.

### 3.1   Getting around

You should now see the Track Display window (the "Tabbed Data" window is behind it).

To load a demo railroad layout, Select "File/Load Example Layout" from the menu on the Track Display window.

After the layout has loaded, click the "Fill" button at the lower right corner of the screen.

You should now see a full-screen depiction of the entire railroad.  Since you are not connected to a network, you will not see any real-time data.
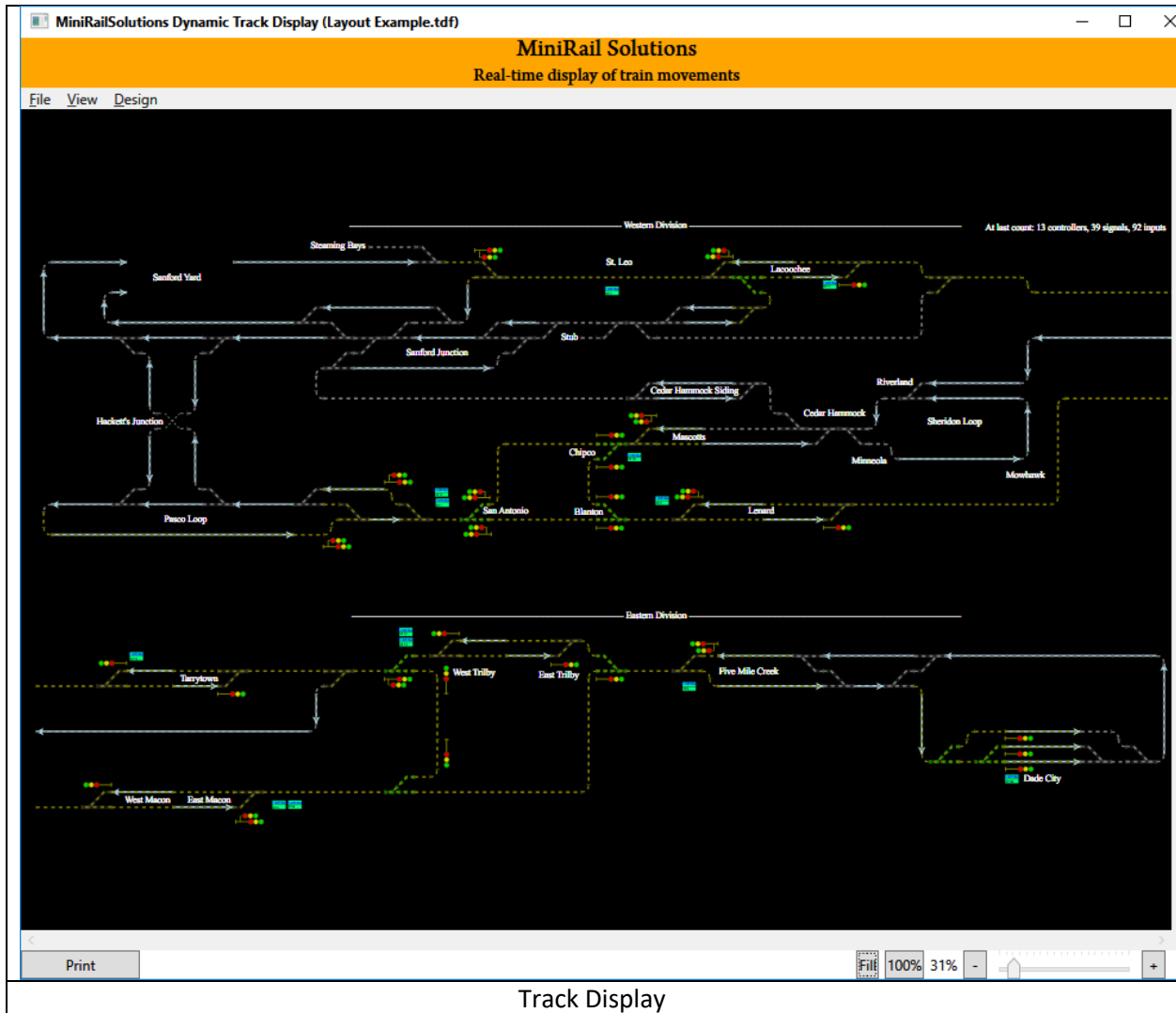
Track Display

Note that because this railroad is "long and thin" this track display was split into two sections. The right-hand end of the top section is physically joined to the left-hand end of the lower section. This allows the entire railroad to be viewed while keeping the individual display objects larger.

This display shows the layout of the track I use for system testing. This image was captured on my home system with no MiniRail network connected.

The signals with no color are signals that are planned but not yet installed and the dotted gray tracks are tracks that are not yet sensed (i.e.: "dark" territory).

The dotted yellow tracks are tracks that are connected but no data is being received for them because I am not connected to a network.

Note "San Antonio" just left of center-screen in the screen shot above.

The next screen shot was taken after I connected one node (#1, the controller at San Antonio) to SComm.  Since I am at home with no connection to the actual network, I am not receiving data from the rest of the railroad.  The image below shows the display after zooming in on the San Antonio area:
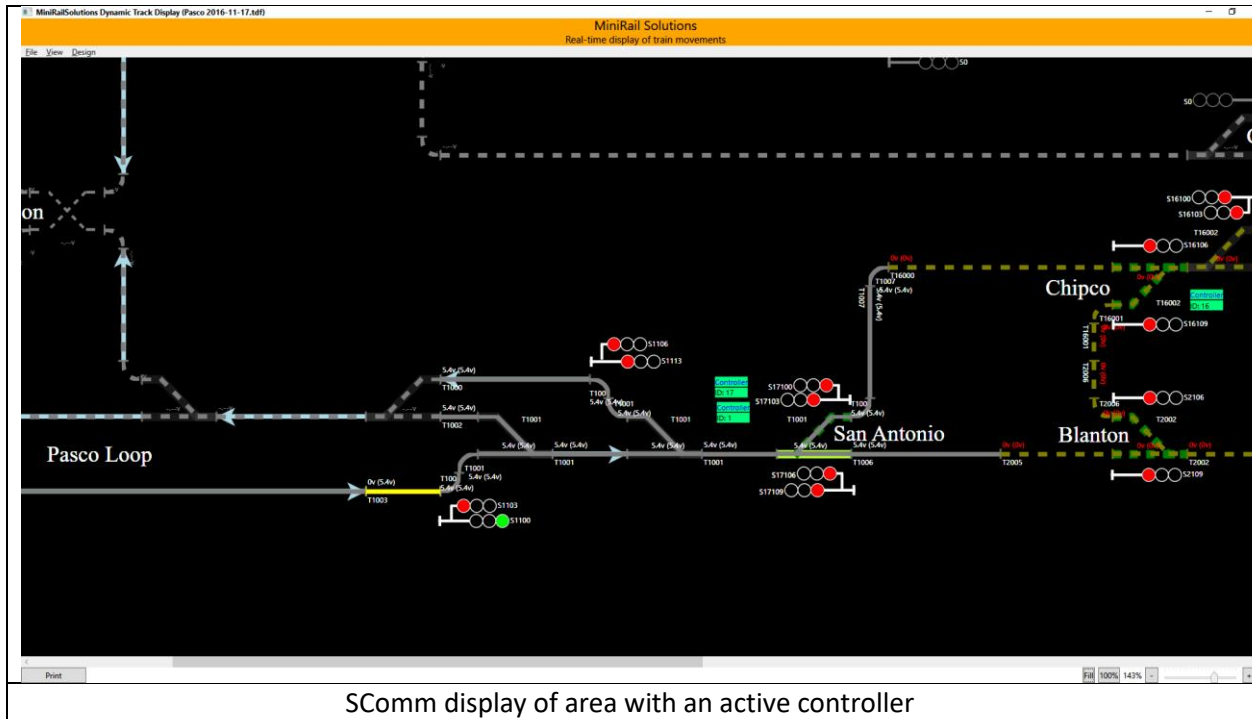


SComm display of area with an active controller

In this display I have turned on the display of IDs and Track Voltages.

A train is shown on the approach track for the signal exiting "Pasco Loop" (track segment is yellow indicating "occupied").  Note that he has a Clear (Green) signal to proceed towards "Blanton".  Note also that the signal towards "Chipco" is Red because the turnout** at San Antonio is set for the straight-through route as indicated by the green bar on the turnout.

**These turnouts have electric switch motors controlled by a post-mounted toggle switch far enough from the signal that the engineer can activate them without being in the block.

The "Tracks" tab shows the real-time status of each detected track in the system along with other details such as the voltage levels used to determine the Occupied/Unoccupied status of a track section.

If you switch to the "Tabbed Data" window you will see several tabbed windows (yours will show no live data).

| Track ID | Age | Status | Reservation Signal | Threshold Voltage | Recent Min Voltage | Recent Max Voltage | LongTerm Max Voltage |
|---|---|---|---|---|---|---|---|
| 1000 | 00:00:01 | Occ_NotOccupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1001 | 00:00:00 | Occ_NotOccupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1002 | 00:00:00 | Occ_NotOccupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1003 | 00:00:00 | Occ_Occupied | 0 | 2.1 | 0 | 0 | 5.4 |
| 1004 | 00:00:00 | Occ_NotOccupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1005 | 00:00:01 | Occ_Occupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1006 | 00:00:02 | Occ_NotOccupied | 1100 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1007 | 00:00:00 | Occ_NotOccupied | 0 | 2.1 | 5.4 | 5.4 | 5.4 |
| 1101 | 00:14:29 | Occ_SComm_StaleData | 0 | 0 | 0 | 0 | 0 |
| 2000 | 00:14:30 | Occ_SComm_StaleData | 0 | 0 | 0 | 0 | 0 |
| 2001 | 00:14:29 | Occ_SComm_StaleData | 0 | 0 | 0 | 0 | 0 |

Track #1003 is the approach track that is occupied in the previous picture.  "Track" #1005 is a "binary input" defined as inverted.  It is one of the "Point Sensing" inputs from the track switch at San Antonio and is telling the system that the turnout is set to the right.

Note that Track #1006 is "Reserved" by signal S1100 (the one that is currently Green).  This reservation prevents an opposing train at the siding east of Blanton from being allowed to proceed to the west (conflicting with the first train).

The voltage display "C.Cv (L.Lv)", shows the "current" (C.Cv) and "Long-Term" (L.Lv) filtered voltages on the track.  If there is a train on the track the "current" voltage should be near 0.0.  The Long-Term voltage shows the filtered voltage when a train is not present.  This will typically be 5.4v (max detectable).  If this voltage falls below about 1 volt when the track is very wet more track bias should be added.  Note: train detection will still work at below 1 volt but, as the Long-Term voltage approaches 0 the reliability of train detection will decrease.

Many other signal systems would misinterpret this low voltage as a train occupying the block which would cause "False Red" signals resulting in unnecessary traffic delays.

The "Signal Heads" tab shows the aspect currently displayed at each signal head.

The "CAN Messages" tab shows each bus messages (in decoded format) as it is transmitted by any controller on the bus.

The "Controllers" tab shows the status of each controller on the bus (current firmware version, time since last restart, last restart code, etc.).

The "Event Log" tab shows diagnostic information such as faults detected, controller restarts (reset button, power-up, firmware fault detected, etc.).

All columns in the tabbed display are sortable by clicking on the heading.

Switch back to the Track Display.

Zooming with the mouse wheel: Place your cursor near "San Antonio" and roll your mouse wheel one direction and then the other to zoom in & out centered on your cursor location.

"Window Zoom": Hold the shift key while pressing and dragging the left mouse button. This will create a rectangle. Release the mouse button and the screen will zoom in to the area you selected.

Mouse Pan: Position the cursor anywhere on the screen, press and drag with the left mouse button. The screen will pan as you move the mouse.

Backspace: Press the "Backspace" key and the screen will return to the previous zoom level.

At any time, you can click "Fill" (lower right) to return to a full-screen display of the railroad.

See below for more zoom & pan options.

## 3.2   Editing A Track Layout

Now we'll do some editing of an existing track layout. If not already there, maximize the Track Display Window. If you don't have it open already, click "File/Load Example Layout" and click "Fill" in the lower right.

Click menu item "Design/Enter Design Mode".

The background of the "Track Canvas" will turn blue. This indicates that the display is in "Design Mode" and the blue area is the area where you can place display objects.

Let's move a section of the railroad …

While holding down the CTRL key, place the cursor just below and to the left of the track corner shown below and press the left mouse key. While holding the CTRL key, 'drag' the mouse to the upper right to the location shown and release the mouse and CTRL key.
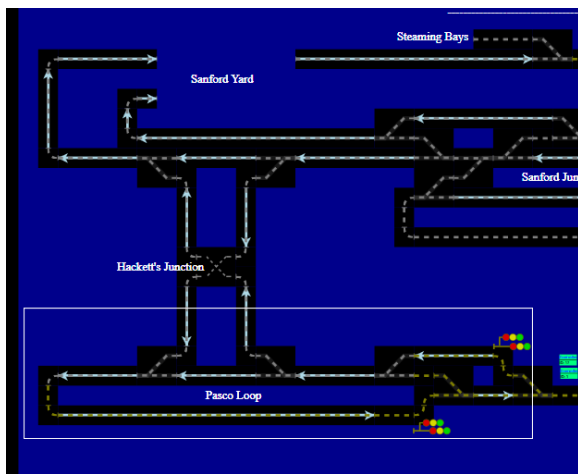
All the objects that were within the rectangle (totally or partially) should now have white borders indicating that they are currently selected.
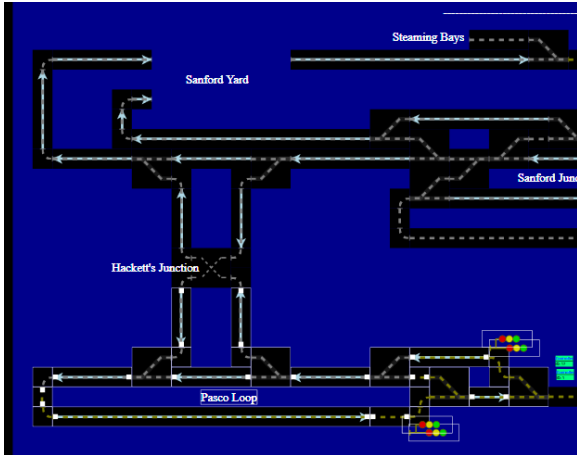


Hold the CTRL key and click on one of the vertical tracks shown coming down from "Hackett's Junction". The white border should disappear, indicating that that track is no longer selected.  Do the same with the second track coming down from Hackett's Junction.  Your screen should now look like this:
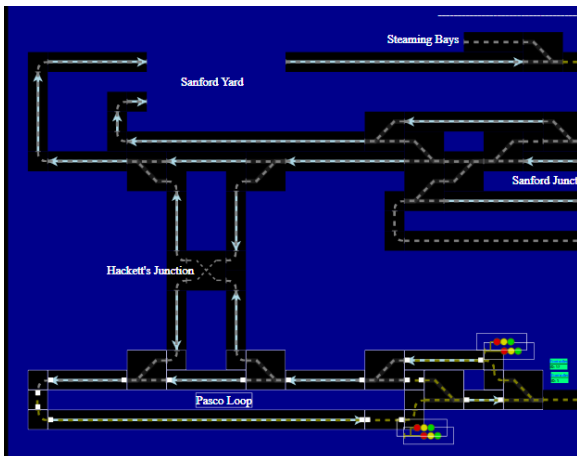


Now position the mouse over any item that is selected and drag straight down until it looks like this:
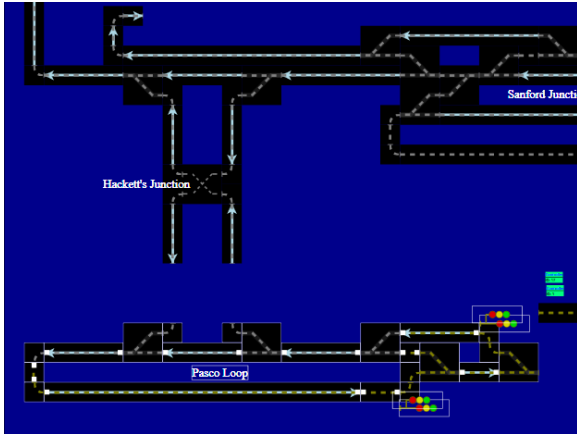
Place the mouse over the left track coming down from Hackett's Junction and click on it. Notice that the items that were selected were de-selected and the track you clicked on is now selected. Position the mouse over the small white square at the bottom end of the track you selected and drag it down until it joins the corner track below it. Do the same with the other track coming down from Hackett's Junction. It should now look like this:
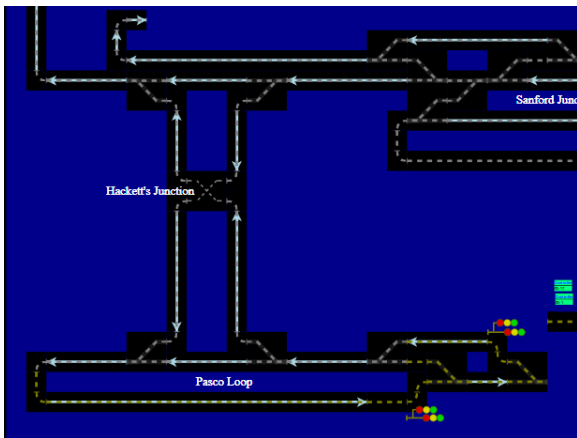


Feel free to select and drag things around the screen.

*(note: due to current conflicts with the mouse handling "Shift-Drag-Window" to window zoom and "Click-Drag" to pan are not available in Design Mode. This will be fixed soon)*

To start a new track diagram, select "Design/Clear" and then select "Fill".

Right-Click anywhere on the blue canvas and select "New/Tangent Track". A new track will appear at the cursor location.

Select the track (Click on it) and drag the small white square on the right-hand end to the right to lengthen the track.

Right-Click and select "New/Track Switch". Select and drag the switch until it connects to the track you drew (notice that it will not allow you to place the switch on top of the track, only next to it).

Right-Click and select "New/Signal Head".  Drag the signal head to wherever you like.  Notice that it can overlap a track item (or, in fact, any item).
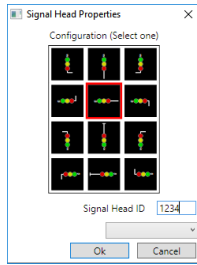


Right-Click on the signal head and select "Properties".  Change its Orientation to "Left" (select second icon from the top I the center column) and its ID to "1234".  Click OK.  Note that the signal head now has all lamps lit.  This is the "non-animated" display of a signal head that has an ID defined but no data is being received for it.

Select menu item "View/Display IDs".  You will now see "S1234" next to the signal head.

Right-Click on the signal head and select "Data".  Note that the current aspect is "SA_SComm_StaleData".  This is not a commanded signal aspect but rather an aspect generated internally by SComm when no network data is available for the signal.  Select OK.

Select menu item "View/Enable Signal Animations".  Note that the signal head is now blinking on and off.  This is the "animated" display for this aspect.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SA_BlockedByReservation | NotPermitted | Wink | 4 | Off | Off | Bright | Block is available but the 'Reservation Track' is not available. |
| SA_EntryDelay | NotPermitted | Wink | 5 | Off | Off | Bright | Block is available but the 'Entry Delay' period has not expired. |
| SA_SComm_StaleData | Error | Wink | 22 | Dim | Dim | Dim | SComm cannot display aspect.  No network data being received for this signal. |
| SA_SComm_Undefined | Error | OnSolid | 0 | Off | Off | Off | Signal is not defined (has no SignalID, etc.) |

Select menu item "Design/Define Signal Aspects …".  A window will open showing the current aspect definitions.  Click on "SA_SComm_StaleData" to highlight it.  Click on "Percent-50" to select it.  Click again to open a drop-down list and select "Wink".  Click on the "Blink Code" field and change it to "22".  If you wanted to, you could also alter the On/Off/brightness state of each lamp.  When done, click on the "X" in the upper-right to close the window.  Notice that the signal is now on for about 1 second, winks off twice, pause, winks off twice, and repeats.

Animation Enabled or Disabled only effects the screen display, not the signals in the field, animation is always enabled in the field except for Searchlight Signals that have it disabled.

Having signal animations enabled is good in that it shows you on the screen exactly what the signal in the field is showing (except in this case because we are using an aspect defined by SComm and never displayed in the field).  Having animations turned on can become distracting with a lot of signals defined.  In this case, you might want to disable it.  Even when it is disabled, the screen still shows what lamps are on and you can always Right-Click the signal and select "Data" to see the actual commanded aspect.

Use the techniques above to drag the signal away from other objects and change its Orientation to "Up" (select properties and select the top icon in the center column).

Add a second signal and change its properties to: Orientation "Up", Mounting "Right" (select the top icon, right column).  Drag it until the upper lamp is next to the yellow lamp of the previous signal and the arm connects to the post of the previous signal.  This is how I depict a route choice at a right-hand turnout.  The upper signal is for "straight through" and the lower one is for the right-turnout.  If it was a left-hand turnout, I would put the second signal on the left side.

If you CTRL-Drag a box around the two signals you can re-position them as a group.

*(Note: There is currently no way to rotate them as a group. This is on the list of enhancements)*

You can delete any item by Right-Clicking an item and selecting "Delete".

Play with the screen by doing adds, moves, etc.

When done, Right-Click on the blue background and select "Fit canvas to layout". The canvas shrinks to fit the layout you have designed. If desired, you can select "Fill" to fill the screen with the layout.

If you wanted to add more items but needed to enlarge the canvas, you can Right-Click on the canvas and select "Increase layout margins". You can do this as many times as you like. When you are done, select "Fit canvas to layout".

Click "Design/Exit Design Mode". You will receive a error indicating that you have not saved the layout. You can either save the layout (menu "File/Save As …") or load a previously saved layout (menu "File/Load …" or "File/Load Example Layout").

*(Later you will be able to abandon the layout)*

That completes a brief tour of the Track Display.


# 4   Track Display

The Track Display window shows a diagrammatic layout of the railroad. If connected to the MiniRail network it will show the real-time status of each component in the railroad (track occupancy, signal displays, turnout positions, etc.).

## 4.1   Available Commands

### 4.1.1   Menu Items

#### 4.1.1.1   *File Menu*

##### 4.1.1.1.1   Load…
This will open a "File Open" dialog box so that you can open a Track Layout that was previously saved. When started, SComm will reopen the layout that was in use when SComm was last exited.

##### 4.1.1.1.2   Load Example Layout
This will load an example layout so you can see how things are displayed.

##### 4.1.1.1.3   Save As…
This allows you to save the current layout. If the file exists, you will be prompted for permission to overwrite it.

#### 4.1.1.1.4   Close

Closes the current Track Display window but does not exit SComm.  The "X" in the upper-right corner of the window can also be used.

#### 4.1.1.1.5   Print…

This will open a Print dialog to print the Track Display

*Warning: This is still in development not yet fully functional.*

### 4.1.1.2   View Menu

#### 4.1.1.2.1   Display Voltages

Turns on the display of track voltages.  This is useful in locating sections of track that might need added track bias or other diagnostic purposes (See "BC002 Signal Controller User Manual" for more information).

#### 4.1.1.2.2   Display IDs

Turns on the display of Object IDs.

#### 4.1.1.2.3   Enable Signal Animations

This turns on the animation of signal aspects displayed in the Track Display window.  If this is enabled, the signals will blink/wink as they do out on the track as defined in the signal aspect definitions (described elsewhere in this manual).  If this is not enabled, the lamps are lit as they are out on the railroad but they do not blink/wink (you can right-click on the signal and select "Data" to determine the actual aspect being commanded).

### 4.1.1.3   Design Menu

#### 4.1.1.3.1   Enter Design Mode

Clicking this menu item will put the Track Display in Design Mode.

The background of the track area will be set to blue to indicate the current boundaries of the track design area.

## 4.2   Zooming the Display

### 4.2.1   Keyboard

### 4.2.1.1   "Backspace"

Return to the previous zoom level.  Useful after having zoomed in/out on an area.  Currently this only 'remembers' the last zoom action.

### 4.2.2   Mouse

### 4.2.2.1   Double-Click

If the display is larger than the viewable area, this will center the display on the location where you double-clicked.

### 4.2.2.2 *Mouse-Wheel*

The mouse wheel can be used to zoom in and out at the location of the cursor.

### 4.2.2.3 *Shift-Left-Drag*

This will allow you to drag a window around the area you want to zoom in on.

## 4.2.3 Zoom Control Panel

This is in the bottom right corner of the display.

### 4.2.3.1 *Fill*

This will zoom the window in/out so that the track layout completely fills the available window space.

### 4.2.3.2 *100%*

Zooms to 100% (not really useful at the moment)

### 4.2.3.3 *<%>*

This indicates the current zoom level.

### 4.2.3.4 *"-"*

Click this to zoom out

### 4.2.3.5 *<Slider>*

Move this to change zoom level.

### 4.2.3.6 *"+"*

Click this to zoom in

## 4.3 Working with the Track Display Objects

All Track Display objects support setting (in Design Mode) and displaying of the object definition and current data (track voltage, etc.). This is accomplished by right-clicking on the object.

For more information see the Design Mode section.

### 4.3.1 Signals

By right-clicking on a signal and selecting "Data" you can see the name of the current aspect being commanded to the signal.

### 4.3.2 Tracks

By right-clicking on a track section (tangent, corner, switch, etc.) and selecting "Data" you will see a "Strip Cart" style graph of the current voltage on that section of track:

Track Voltage Display
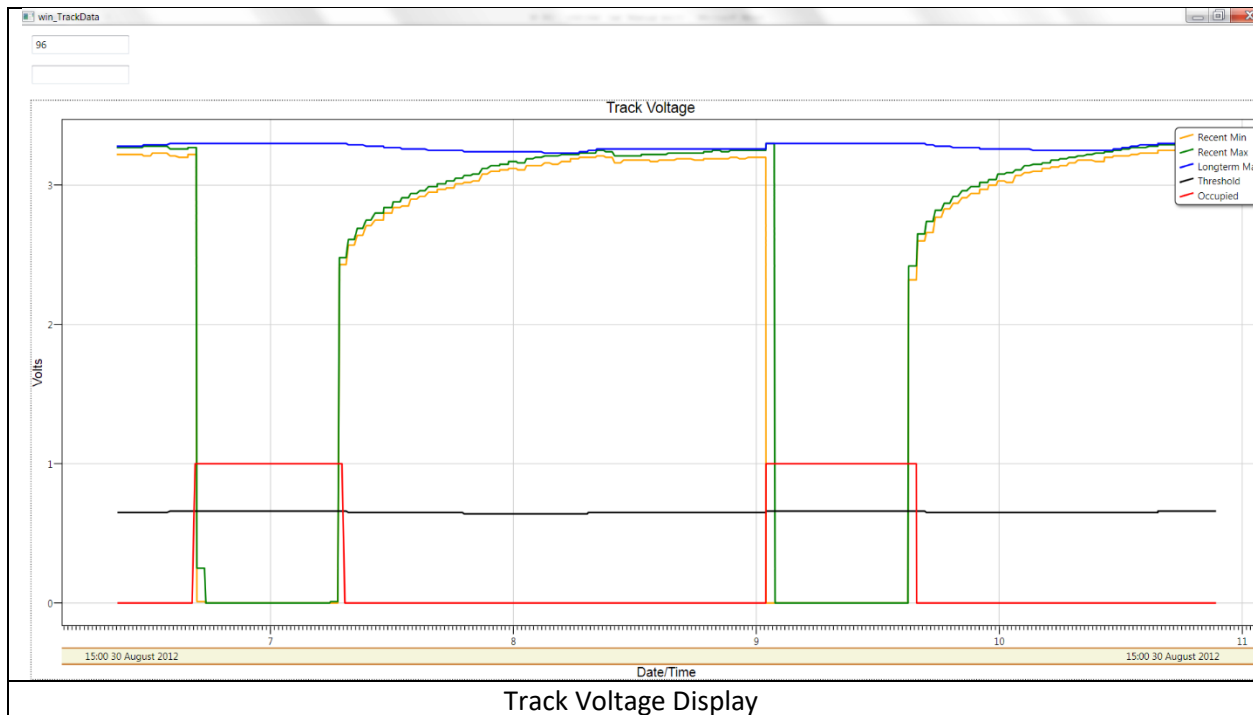
This display shows two trains passing through a section of track (about 500 feet long with mostly plastic ties).

Note that, as the train entered (left side of chart) the track voltage (orange line) went to (very near) zero and the "Occupied" status (red line) immediately went to 1 (occupied). As the train left the track section the voltage rose to about 2.5 volts but the track did not go "unoccupied" for several seconds. This delay is to ensure the train is, in fact, out of the block and not on a dirty section, etc.

Also note that, as the train left the track section, the voltage did not immediately return to just above 3 volts. This effect is due to the R/C effects of the rail contact with the ties, etc.

If, as the train was traversing the track, you noticed a slight rise in the track voltage it would probably indicate that a bond wire has been cut/dislodged causing a "high resistance joint". This allows you to see problems before they cause signal problems.

You can have multiple Track Voltage charts open at once. Each window is resizable.

## 4.4   Available Commands (Design Mode)

### 4.4.1   Menu Items
When in Design Mode (Design/Enter Design Mode), the Design menu item changes to the following items:

#### 4.4.1.1   Exit Design Mode
This exits Design Mode and resets the background to black. If modifications have been made you will be prompted to save the layout.

This deletes all objects in the current track layout.

### 4.4.1.3 Define Signal Aspects…

This will open a window that allows you to define all the signal aspects used in the layout. The only columns that are user-modifiable are "BlinkMode", "BlinkCode", "Green", "Yellow", "Red".

For a detailed description of each aspect see the "BC002 Signal Controller User's Manual".

Note: Currently these definitions only affect what SComm displays for each aspect. When the changes are complete that will allow SComm to download the configuration information directly to the controllers this will also define what the signal heads in the field display (currently their aspects are defined in the separate text configuration file).

| Aspect | Type | BlinkMode | BlinkCode | Green | Yellow | Red | Description |
|---|---|---|---|---|---|---|---|
| SA_Permitted | Permitted | OnSolid | 0 | Bright | Off | Off | Block Is unoccupied. Train is permitted to enter. All other block entries are at a 'Stop' aspect. |
| SA_ReservationInProgress | NotPermitted | Wink | 4 | Off | Off | Bright | Block is available but the reservation of the 'Reservation Track' has not yet been granted. |
| SA_Stop | NotPermitted | OnSolid | 0 | Off | Off | Bright | Block is in use. Train must stop. |
| SA_Idle | Idle | Wink | 1 | Off | Off | Dim | Block is idle. Not occupied and no trains requesting entry. |
| SA_Approach | Permitted | OnSolid | 0 | Off | Bright | Off | Block Is unoccupied. Train is permitted to enter. All other block entries are at a 'Stop' aspect. The 'Destination Track' is occupied |
| SA_UnknownStatus | Error | Blink | 12 | Off | Off | Bright | Out of service. There is a track critical to block evaluation whose status is unknown. |
| SA_CommLoss | Error | Blink | 13 | Off | Off | Bright | Out of service. The signal head is not receiving aspect commands (probable network problem). |
| SA_IdleApproach | Idle | Wink | 1 | Off | Off | Dim | Block is idle. Not occupied but 'Destination Track' is occupied. |
| SA_BlockedByDestinationAndOpposing | NotPermitted | Wink | 3 | Off | Off | Bright | Block is available but the 'Opposing' and 'Destination' tracks are occupied. |
| SA_PermittedWithSwitchPointStop | NotPermitted | Wink | 2 | Off | Off | Bright | Block is available but the switch is not set for this direction. |
| SA_IdleWithSwitchPointStop | Idle | Wink | 1 | Off | Off | Dim | Block is Idle. Switch points are not set for this direction. |
| SA_ApproachWithSwitchPointStop | NotPermitted | Wink | 2 | Off | Off | Bright | Block is available but the switch is not set for this direction. The 'Destination Track' is occupied. |
| SA_IdleApproachWithSwitchPointStop | Idle | Wink | 1 | Off | Off | Dim | Block is idle. Not occupied but 'Destination Track' is occupied. Switch points are not set for this direction. |
| SA_BlockedByDestinationAndOpposingWithSwitchPointStop | NotPermitted | Wink | 2 | Off | Off | Bright | Block is available but the 'Opposing' and 'Destination' tracks are occupied and the switch is not set for this direction. |
| SA_Permitted_NotSelected | Error | Blink | 14 | Off | Off | Bright | Out of service. Conditions are such that the block is available but this signal is not 'Enabled'. |
| SA_SenderPowerOn | Error | OnSolid | 0 | Bright | Bright | Bright | Out of service. The logic that drives this signal has powered on but not yet sent an updated aspect. |
| SA_SignalheadPowerOn | Error | OnSolid | 0 | Bright | Bright | Bright | Out of service. The signal head driver has powered on but not yet received an aspect command. |
| SA_SenderRestart | Error | Blink | 15 | Off | Off | Bright | Out of service. The logic that drives this signal has restarted but not yet sent an updated aspect. |
| SA_SignalheadRestart | Error | Blink | 16 | Off | Off | Bright | Out of service. The signal head controller has restarted but not yet received an aspect command. |
| SA_IdleBlockedByReservation | Idle | Wink | 1 | Off | Off | Dim | Block is idle. Not occupied but the 'Reservation Track' for this signal is unavailable. |
| SA_BlockedByReservation | NotPermitted | Wink | 4 | Off | Off | Bright | Block is available but the 'Reservation Track' is not available. |
| SA_EntryDelay | NotPermitted | Wink | 5 | Off | Off | Bright | Block is available but the 'Entry Delay' period has not expired. |
| SA_SComm_StaleData | Error | Percent_50 | 0 | Dim | Dim | Dim | SComm cannot display aspect. No network data being received for this signal. |
| SA_SComm_Undefined | Error | OnSolid | 0 | Off | Off | Off | Signal is not defined (has no SignalID, etc.) |

Signal Aspect Definitions

| Column | Description |
|---|---|
| Aspect | The name of the aspect |
| Type | Type of aspect (Permitted – train allowed to proceed, Not Permitted – train must stop, Idle – block is clear and no approaching trains, Error – indicates block status cannot be determined. |
| BlinkMode | OnSolid, Wink (lamps mostly ON and winking OFF to display code), Blink (lamps mostly OFF and blinking ON to display code), Percent-50 (50% ON, 50% OFF) |
| BlinkCode | Number to be Blinked or Winked |
| Green, Yellow, Red | The brightness to be used for the corresponding lamps. Valid values are: OFF, Dim (use the brightness level defined for "Dim" signals), Bright (use the brightness level defined for "Bright" signals) (see "Aspect Configuration" in the BC002 User's Manual) |

### 4.4.1.4 Reset signal aspects to default

This will reset all the signal aspects to the recommended defaults.

### 4.4.2 Increase Layout Margins

If you are starting with a blank layout or if you are adding items at the edge of an existing layout you will need to create more space to add your item(s). You can do this by right-clicking on the background and selecting "Increase Layout Margins". You can do this as many times as needed to create the room you need.

### 4.4.3 Fit Canvas to Layout

When you are done editing (or anytime) you can fit the design canvas to the current layout by right-clicking on the background and selecting "Fit Canvas to Layout".

### 4.4.4 Adding New Display Objects

To add a new display object, you right-click where you want the object to be placed and place your mouse over "New". This will present you with a sub-menu from which you can select the type of object you want to create.

After you have created the object you can right-click on it and change its properties, display its data[1], or delete the object.

### 4.4.5 Selecting Objects

#### 4.4.5.1 Click

You can select an object by clicking on it (its border will change to white, indicating that it is selected).

If you click on the background, all currently selected objects will be de-selected.

#### 4.4.5.2 CTRL-Click

If you hold the Control Key and Click on an object, the object will be added to the list of selected objects (if not currently selected) or removed from the list of selected objects (if currently selected).

#### 4.4.5.3 Click-Drag

If you click on a selected object and drag while holding the mouse button, you can drag the currently selected objects as a group to a new location. When you are satisfied with the new location, release the mouse button.

Note: If any of the currently selected objects are "Track Objects" (tangent, switch, etc.) SComm will only allow you to drag the objects to a location that:

- Is located at a "Track Grid" location (SComm uses a 20x20 pixel grid for track items)
- None of the track items involved in the move will end up being on top of any other track Objects.

---

[1] As soon as you associate an ObjectID with the object, any available live network data for the object will be available by selecting "Data".

As you move the mouse the objects will follow but they will only take up valid locations. If the objects are not moving to where you expect, be sure that the desired location does not cause Track Objects to overlap.

If you are dragging a large number of objects do it slowly because there is significant computation involved in testing the new location for validity.

### 4.4.5.4   CTRL-Window-Drag

If you hold the Control Key and Click-Drag you can create a selection window. When you release the mouse button, any object that was within the window (totally or partially) will be added to the list of selected objects.

You can CTRL-Window-Drag multiple areas and then use CTRL-Click to add/delete individual objects to/from the list of selected objects.
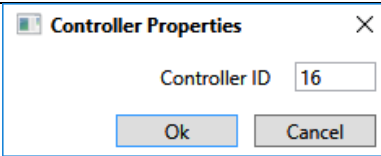
### 4.4.6   Editing Objects

You can edit new or existing objects by right-clicking it and selecting "Properties".
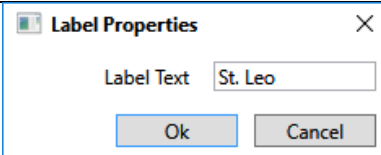
You can move any object using the select/move procedures described above.

You can delete any object by right-clicking it and selecting "Delete". (Note: if you delete an object all its property information is lost if you save the layout. Also, "Undo" is not yet supported.)

### 4.4.6.1   Controllers



| Controller Properties | | |
|---|---|---|
| Property | Value Range | Description |
| Controller ID | 0-31 | This is the unique ID for this controller. |

### 4.4.6.2   Labels



| Label Properties | | |
|---|---|---|
| Property | Value Range | Description |
| Label Text | -- | Arbitrary Text to appear in the label location |

### 4.4.6.3  Signals



**Signal Head Properties**

| Property | Value Range | Description |
|---|---|---|
| Configuration | -- | Select the rotational orientation you need (i.e.: "Up" will be a signal head with its base towards the bottom of the screen and the lamps toward the top of the screen) and the mounting type.  Mounting type is used when multiple heads are mounted together.  "Left" and "Right" are heads mounted on the Left/Right side of another head. |
| Signal Head ID | 0-65535 | This is the unique ObjectID of this signal head.  A value of 0 indicates that this signal head will not be updated with real-time data (e.g.: is not yet installed, etc.) |

The screen depiction of the signal head does not have to reflect how it appears in the field.  For example, double/triple heads, heads on a signal bridge, etc. can be shown as ground mounted signals.  If required, more mounting types can be added.

### 4.4.6.3.1  Track Crossing
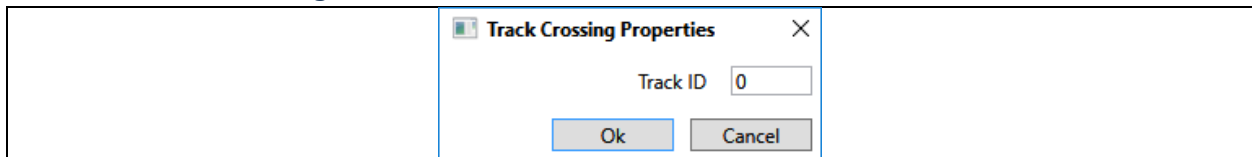


**Track Crossing Properties**

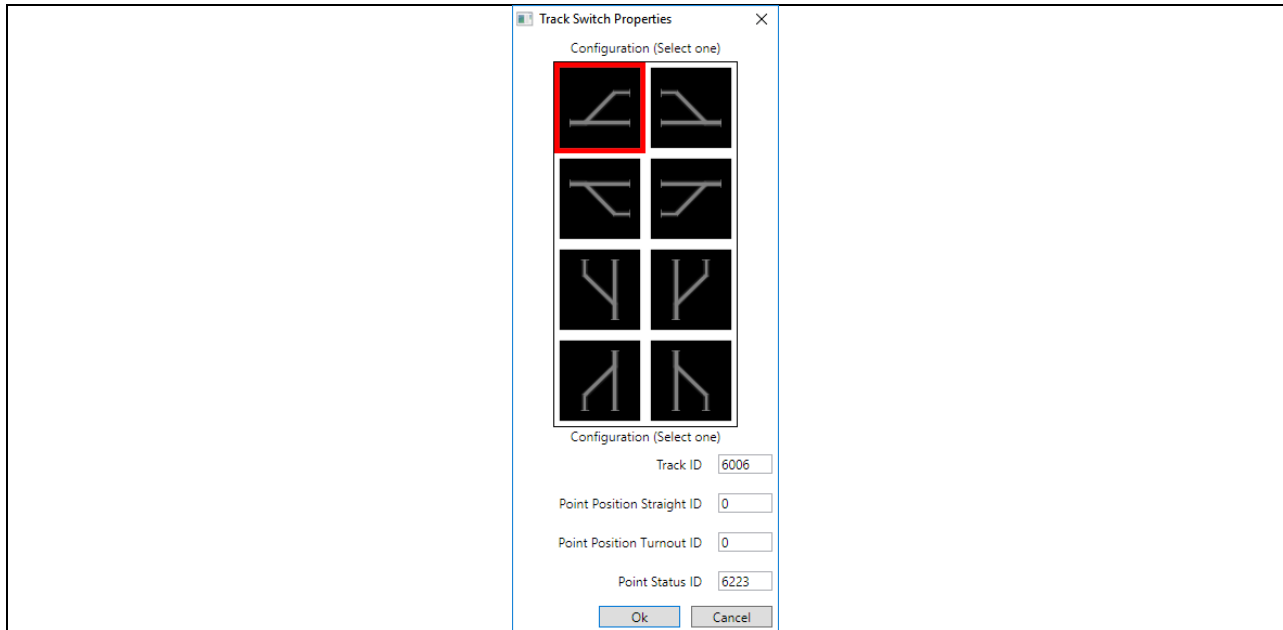| Property | Value Range | Description |
|---|---|---|
| Track ID | 0-65535 | This is the ObjectID of this track section.  A value of 0 indicates that this track section will not be updated with real-time data (e.g.: is not yet installed, etc.) |

### 4.4.6.4  Tracks

### 4.4.6.4.1  Corner Tracks



| Corner Track Properties | | |
|---|---|---|
| Property | Value Range | Description |
| Orientation | -- | This selects which "corner" of a box the corner represents. |
| Track ID | 0-65535 | This is the ObjectID of this track section.  A value of 0 indicates that this track section will not be updated with real-time data (e.g.: is not yet installed, etc.)  Note: It is common for multiple sections of track on the display to have the same Track ID as other sections of track. |

Note: It is common for multiple sections of track on the display to have the same Track ID as other sections of track.

### 4.4.6.4.2 Track Switches



Corner Track Properties

| Property | Value Range | Description |
|---|---|---|
| Configuration | -- | This selects which type of turnout this is to be depicted (left-hand or right-hand, etc.) * |
| Track ID | 0-65535 | This is the ObjectID of this track section. A value of 0 indicates that this track section will not be updated with real-time data (e.g.: is not yet installed, etc.) Note: It is common for multiple sections of track on the display to have the same Track ID as other sections of track. |
| Point Position Straight ID | 0-65535 | If this input ID is in the "unoccupied" state (i.e.: voltage present) the display will indicate that the switch is set for the straight-through position. A value of 0 indicates that this option is not used. ** |
| Point Position Turnout ID | 0-65535 | If this input ID is in the "unoccupied" state (i.e.: voltage present) the display will indicate that the switch is set in the turnout position. A value of 0 indicates that this option is not used. ** |
| Point Status ID | 0-65535 | This input is the ID of a "Multi-Select" device that indicates the position of the switch points (See the "BC002 Signal Controller User Manual) *** |

* The Configuration choice is not usually connected to the actual switch in the field, but rather what makes for a more understandable track diagram. Since we usually use right-hand-running for sidings I usually depict the straight section of the switch as the entry side at each end of the siding (see "Lenard" in the example track layout).

** These typically represent two inputs from a switch motor that gives +12 on one line or the other if the switch is "hard over" to one of these positions and 0 volts on both if in transition. The display will indicate "in transition" status with dotted lines rather than a solid green line depicting the current position.

*** if "Point Status ID" is non-zero, "Point Position Straight ID" & "Point Position Turnout ID" must be zero.  If "Point Position Straight ID" or "Point Position Turnout ID" is non-zero, "Point Status ID" must be zero.

### 4.4.6.4.3  Tangent Tracks



| Corner Track Properties | | |
|---|---|---|
| Property | Value Range | Description |
| Orientation | -- | This selects a track running vertically (and can be lengthened down) or a track running horizontally (and can be lengthened to the right) |
| Direction of Traffic Flow | -- | This indicates the "nominal" direction of traffic flow.  If Bi-directional is selected there no arrow will be placed on the track segment.  If one of the other options is selected, an arrow will be placed on the track segment in the appropriate direction. |
| Track ID | 0-65535 | This is the ObjectID of this track section.  A value of 0 indicates that this track section will not be updated with real-time data (e.g.: is not yet installed, etc.)  Note: It is common for multiple sections of track on the display to have the same Track ID as other sections of track. |

The "Direction of Traffic Flow" is used to annotate the display to indicate the normal direction of traffic flow (e.g.: the normal flow on parallel passing sidings).  In the future, the controller firmware and SComm will be enhanced to show the *actual* flow of traffic, including the current direction of train travel on a bi-directional section of track.

#### 4.4.6.4.3.1   Changing the length of a track
To resize (lengthen/shorten) a tangent track you click-and-drag the handle (small white square box) on the lower (for vertical tracks) or right-hand end (for horizontal tracks).

SComm will only allow tracks to have a length that is a multiple of the track grid (currently 20x20 pixels) and will not allow you to cause the track to overlay another track object.

# 5  Tabular Data Display



| Signal ID | Age | Aspect | Reserved Track | Reserved Seq |
|---|---|---|---|---|
| 103 | 05:22:54.8070442 | SA_SComm_StaleData | 0 | |
| 104 | 05:22:54.8155670 | SA_SComm_StaleData | 0 | |
| 105 | 05:22:54.6170321 | SA_SComm_StaleData | 0 | |
| 106 | 05:22:54.6155346 | SA_SComm_StaleData | 0 | |
| 107 | 05:22:54.6185424 | SA_SComm_StaleData | 0 | |
| 116 | 05:22:54.8145641 | SA_SComm_StaleData | 0 | |
| 117 | 05:22:54.8105538 | SA_SComm_StaleData | 0 | |
| 118 | 05:22:54.6070118 | SA_SComm_StaleData | 0 | |
| 119 | 05:22:54.6085131 | SA_SComm_StaleData | 0 | |
| 120 | 05:22:54.6100196 | SA_SComm_StaleData | 0 | |
| 121 | 05:22:54.6145321 | SA_SComm_StaleData | 0 | |
| 122 | 05:22:54.6115239 | SA_SComm_StaleData | 0 | |
| 123 | 05:22:54.6130282 | SA_SComm_StaleData | 0 | |
| 124 | 05:22:54.6060093 | SA_SComm_StaleData | 0 | |
| 125 | 05:22:54.8095506 | SA_SComm_StaleData | 0 | |
| 126 | 05:22:54.8130602 | SA_SComm_StaleData | 0 | |
| 204 | 05:22:54.6025001 | SA_SComm_StaleData | 0 | |
| 205 | 05:22:54.6050065 | SA_SComm_StaleData | 0 | |
| 207 | 05:22:54.6035026 | SA_SComm_StaleData | 0 | |
| 1100 | 05:22:54.8120577 | SA_SComm_StaleData | 0 | |

Tabular Data Display

This window will usually open behind the Track Display window.

The primary purpose of this window is to display real-time data in tabular form.

## 5.1  Menu Items

### 5.1.1  File

#### 5.1.1.1  Layout

##### 5.1.1.1.1  Save

(Partially implemented) Saves the current window layout (screen position, size, etc.) so that they can be restored when SComm starts up.

##### 5.1.1.1.2  Restore

(Partially Implemented) Restore the last saved window layout.

#### 5.1.1.2  Open Comm Port

Open the communications link to the MiniRail Network.  Currently this is via a USB-to-serial cable and adapter connected to the Diagnostics port of any BC002 controller.

Before you can open the communications link you must configure it (See Config/Config Settings).

#### 5.1.1.3  Close Comm Port

Close the communications link to the MiniRail Network.  This is used to close the link so that the configuration of the port can be modified (See Config/Config Settings).

### 5.1.1.4 About

Displays an "About Box" with version information, etc.

### 5.1.1.5 Exit

Closes all windows and Exits SComm.

## 5.1.2 Windows

### 5.1.2.1 Track Display

This opens a Track Display window and loads the track layout that was open when SComm last shutdown.

### 5.1.2.2 Controller Link Map

This opens a dialog box that shows which controllers each controller can "hear" and an indication of error rate. This is useful in diagnosing data bus problems.

If actual network data were available, the dialog box below would contain a grid showing message loss rates between each controller.

(More information about interpreting this data will be added later)



Controller Link Map
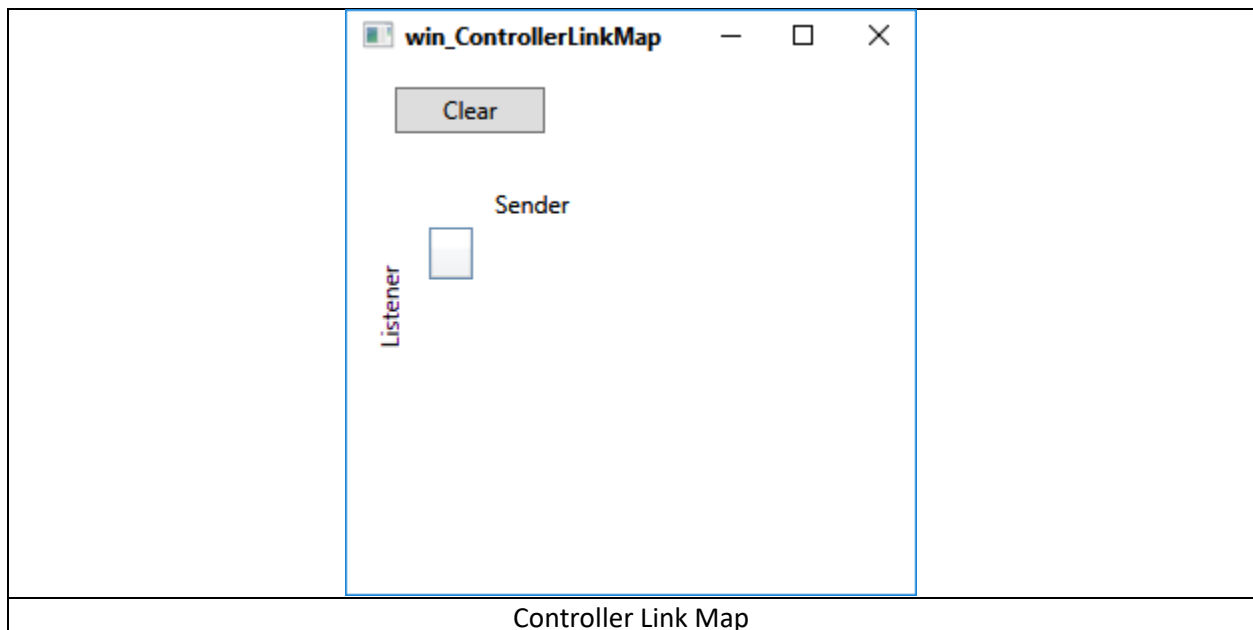
## 5.1.3 Config

### 5.1.3.1 Config Settings

This opens a dialog box that allows you to change the communications settings for the link to the BC002 controller.

| Configuration Settings |
|---|
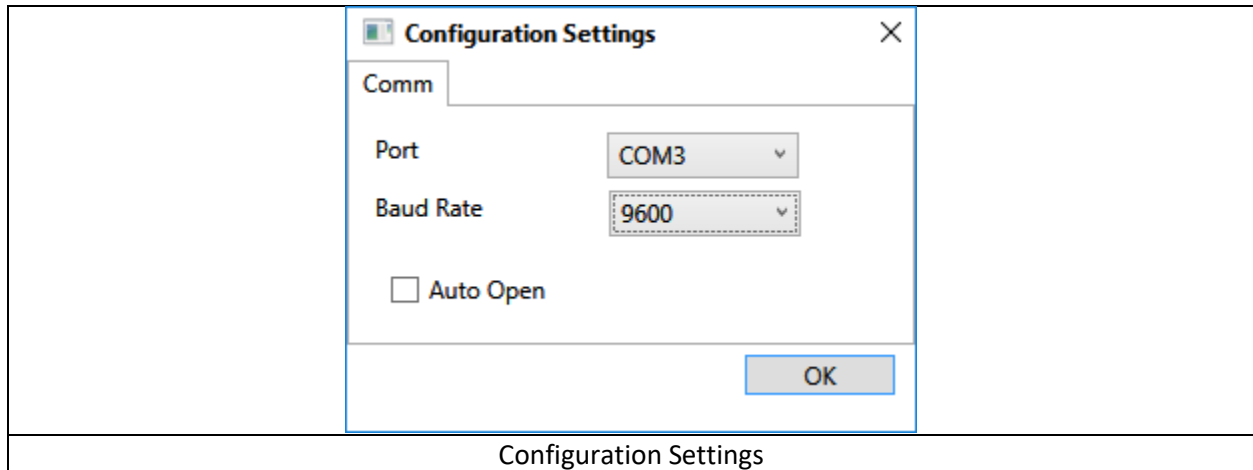
Set the Port to the port that the USB-to-serial cable is connected to.

Currently the baud rate must be set to 9600 baud.

If the "Auto Open" checkbox is checked SComm will automatically open the communications link when it starts.

(Note: Currently, if there is an error opening the link this configuration information is cleared and must be reset.  This will be addressed in a future release.)

### 5.1.4   Logging
(not yet implemented) This will allow logging of network traffic for later problem analysis or for "Playback" when someone says that they didn't run a red signal ☺

### 5.1.5   Control
In the future, this will allow issuing various commands to the network such as "Lamp Test", etc.

#### 5.1.5.1   Set Signal Brightness
(not yet implemented) This command will set reduce the signal brightness level.  For example, if the signals are defined at 80% brightness and a "Set brightness to 50%" command is issued, the signals will be set to 40% brightness.  This can be useful if the signals are fine during the day but too bright at night.

### 5.1.6   Help

#### 5.1.6.1   User's Manual
Opens the "SComm User Manual.pdf" file using the default program configured on your system for "pdf" files.
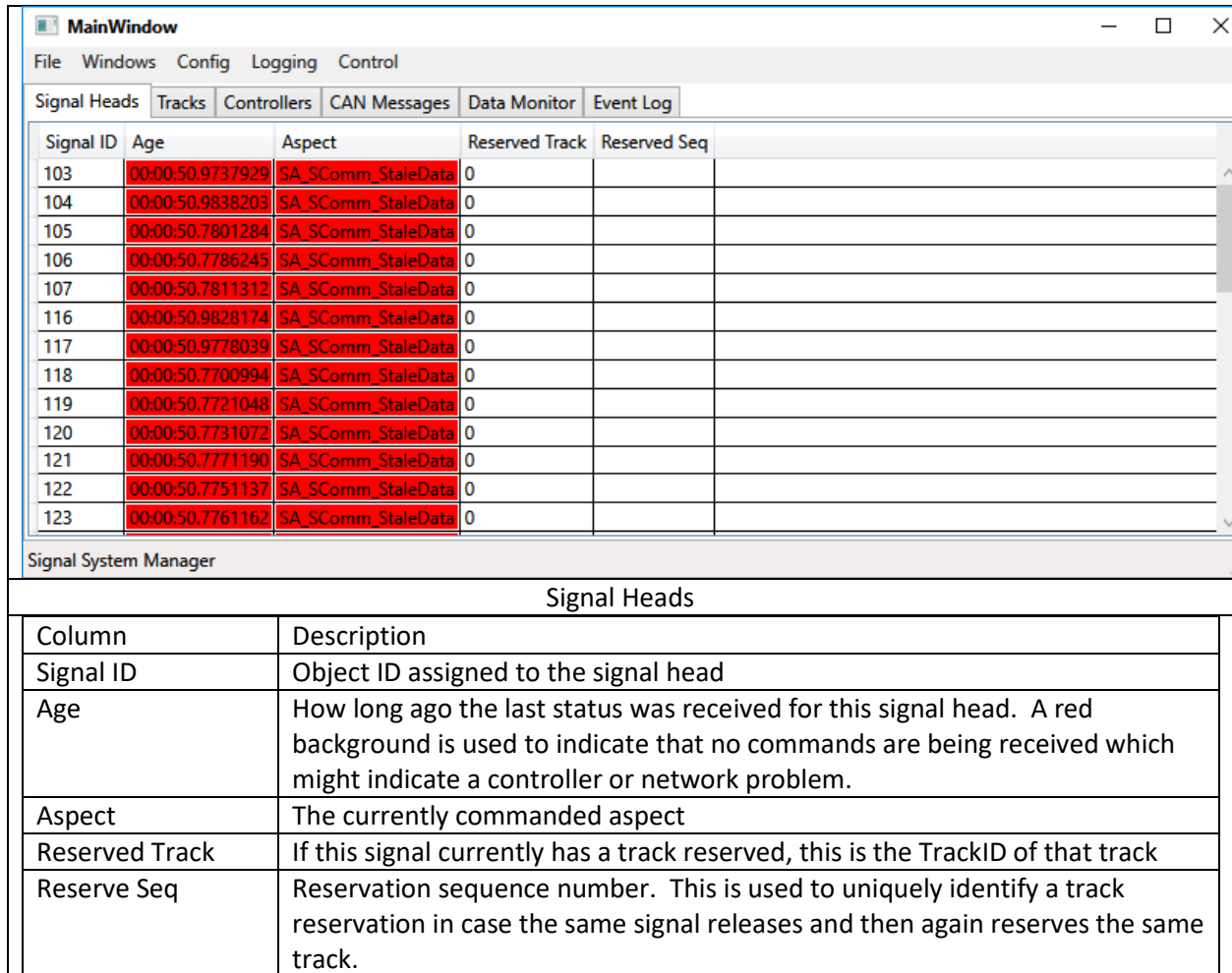
#### 5.1.6.2   Release Notes
Opens the "ReleaseNotes.txt" file using the default program configured on your system for "txt" files.

## 5.2 Tabs

### 5.2.1 Signal Heads

This tab shows information about the aspects currently being commanded to each signal head in the network.

Signal heads will appear in this list if they were defined in a currently active Track Display or if SComm has seen network messages that reference a signal head.



Signal Heads

| Column | Description |
|---|---|
| Signal ID | Object ID assigned to the signal head |
| Age | How long ago the last status was received for this signal head. A red background is used to indicate that no commands are being received which might indicate a controller or network problem. |
| Aspect | The currently commanded aspect |
| Reserved Track | If this signal currently has a track reserved, this is the TrackID of that track |
| Reserve Seq | Reservation sequence number. This is used to uniquely identify a track reservation in case the same signal releases and then again reserves the same track. |

### 5.2.2 Tracks Tab

This tab shows information about each track that SComm knows about.

Tracks will appear in this list if they were defined in a currently active Track Display or if SComm has seen network messages that reference a track.

| | | Tracks |
|---|---|---|

| Column | Description |
|---|---|
| Track ID | Object ID assigned to the track |
| Age | How long ago the last status was received for this track. A red background is used to indicate that no commands are being received which might indicate a controller or network problem. |
| Status | The status of the track:<br>Stale Data – No data being received<br>Not-occupied – No train present<br>Occupied – There is a train on this track |
| Reservation Signal | Signal ID of the signal that has this track reserved (0 = none) |
| Threshold Voltage | This voltage is calculated by the filtering algorithm. If the "Recent Min Voltage" falls below the Threshold Voltage, the track will be marked as occupied. |
| Recent Min Voltage | This is the lowest voltage seen on the track in the short-term window |
| Recent Max Voltage | This is the highest voltage seen on the track in the short-term window |
| LongTerm Max Voltage | This is a smoothed value calculated by the filtering algorithm calculated to eliminate false occupied/un-occupied indications caused by changing track conditions. |

### 5.2.3   Controllers Tab

This tab shows information about each controller node that SComm knows about.

Controllers will appear in this list if SComm has seen network messages the controller.

There is a lot of information here (screen is too wide to show). Most of it is statistical in nature and only of use if you were to call me for help in identifying a network problem. I have summarized many of them below. Large numbers do not, in themselves, indicate a problem



Controllers

| Column | Description |
|---|---|
| Controller ID | Object ID assigned to the controller |
| Age | How long ago the last status was received for this controller.  A red background is used to indicate that no commands are being received which might indicate a controller or network problem. |
| Status | Normal, Stale Data, etc. |
| Reserved Track | If this signal currently has a track reserved, this is the TrackID of that track |
| Restarts | Number of controller restarts since SComm was started |
| Restart Reason | This is the reason for the last restart (see Asserts.txt for listing) |
| Firmware Version | Version of the firmware currently running in the controller |
| Lost Msgs | Test Msgs from the controller to SComm that were lost (small number is Ok, 255 max value) |
| Mem Failures | Number of times that the controller ran out of memory (should never be > 0) |
| Heap Gap | A rough measurement of the amount of free memory available |
| CAN Msg Errors | Should always be 0, max value 255 |
| CAN Msgs Lost Arbitration | Common for this number to rise slowly over time.  If rising rapidly it indicates very high bus traffic.  Max value 255. |
| CAN Msgs Flushed | Common for this number to rise slowly over time.  If rising rapidly it indicates very high bus traffic or total bus failure (i.e.: no bus connected to the controller, or only one controller on the bus).  Max value 255. |
| CAN Xmit Queue Overflow | Common for this number to rise slowly over time.  If rising rapidly it indicates very high bus traffic.  Max value 255. |
| <all "Serial" values> | These all relate to the Diagnostics Port and are not significant unless the Diagnostics port is being used for XBee radios, a bridge, or communicating with SComm. |

### 5.2.4   CAN Messages Tab

This tab shows a decoded version of each message received by SComm from the network.

It is used mostly for bench testing because, on a live network, the message data rate is too high for this to be useful (on my test railroad there can be over 50 messages per second).

The display below shows track status messages, controller statistics, and signal head command messages.

| CAN Messages | |
|---|---|
| Column | Description |
| Arrival Time | Time message was received by SComm |
| Source ID | In "status" type messages, this is the Object ID that generated the message. For "Command" type messages, this is the ObjectID that the command is directed to. |
| Message ID | Type of message |
| Data | A decoded representation of the data portion of the message |

### 5.2.5   Data Monitor Tab

Currently this just shows the number of network messages that SComm has received since it was started.

### 5.2.6   Event Log Tab

This tab records certain events like the status of SComm's communications link, restart codes from the controller that SComm is connected to as well as trace messages, etc. used for debugging firmware issues.

The screen below indicates:

- SComm opened its serial port

- The controller restarted twice due to me pressing the reset button on the controller (1,2,0), once due to Power ON (1,1,0), and once due to low power supply voltage because I purposely shorted the power terminals momentarily (1,3,0).



CAN Messages
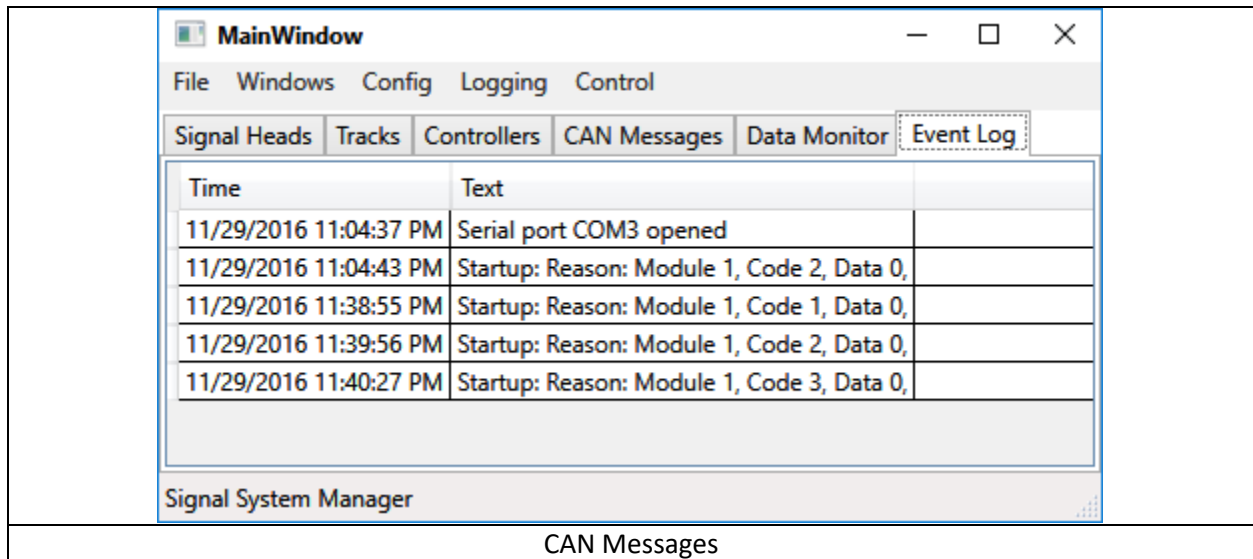
# 6  Layout File Format (Track Definition File)

SComm saves the track layout in a Track Definition File (tdf).

This file is in XML format.

You are free to use the file for other purposes (build your own display program with the help of MiniRailNet.dll) or make mass configuration changes like renaming objects, etc.  You can even add objects by following the pattern you see in the file (I may document the format more fully in a future release of this manual).

Obviously, you must be careful not to modify it in an "incompatible" way but as long as you don't add fields that SComm doesn't know about or violate validation rules (e.g.: change IDs to a value that is greater than 65535) you should be ok.
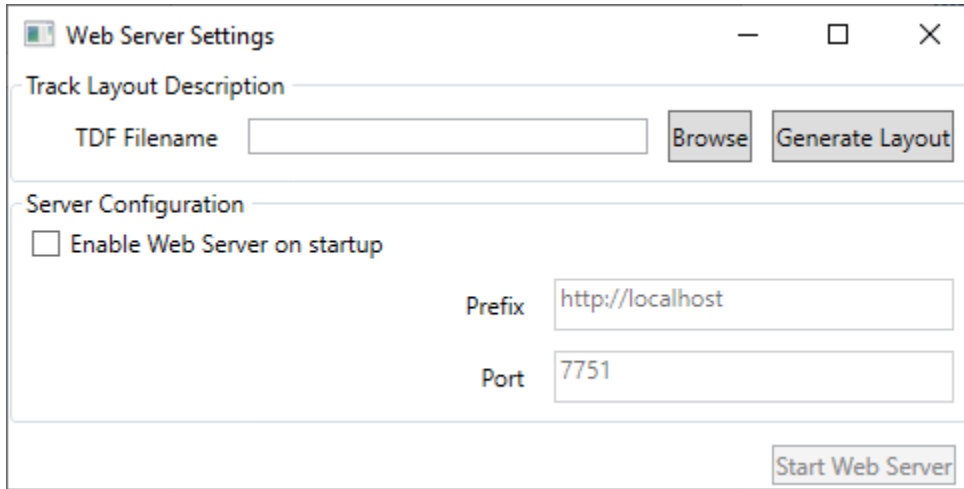
The contents will change over time.  This will consist mostly of additions such as completing the information that SComm will need to take over the downloading of configuration data to the controllers) and not modifications to existing data items.

I expect the TDF to remain as an XML file but I do not guarantee it.

# 7  Web Server Support

SComm supports placing the real-time track display on the internet.  This display is a subset of SComm's track display window.

To configure the web display click the "Config/Web Server" menu item.  This will display the following:



First you need to provide the TDF file to be used to generate the web display from.  After providing a file name click "Generate Layout".  This generates the file used by the web server.

Notes:

1) You need to regenerate this file if a change is made in the TDF that you want reflected on the web display.
2) The TDF file does not need to be the TDF file used by SComm.  SComm and the web can have different displays.

## 7.1   Web Server Settings

Under "Server Configuration":

***Prefix:***  Leave as "http://localhost"

***Port:***    Provide the port number that the SComm server should be listening on

***Enable Web Server on startup:***  Select this checkbox if you want SComm to automatically start the server on startup

***Start Web Server:***        Click to start web server

## 7.2   Accessing The Web Display

You can access the display from the same PC that SComm is running on by using a browser to:

http://localhost:<port>

Example: http://localhost:7751

From the internet:

http://<your domain>:<port>

Example: [http://OurRailroad.org:7751](http://OurRailroad.org:7751)

Most railroads would add a link to their club web page that redirects the user to this link instead of having them type this in.

The display can me accessed by any device with access to the internet Snare Phone, Tablet, etc.

## 7.3   Required Windows Settings

If The web server will not start due to "Access Denied" check to see if the URL Access Control List entries were added.  Add the following using a command prompt running with administrator privileges:

For the local connection:

netsh http add urlacl url="http://localhost:<port>/" user=everyone

Where <port> is the port you configured in the Server Configuration.


For external connection:

netsh http add urlacl url="http://<address>:<port>/" user=everyone

Where <address> is the PC's LAN address, NOT the "external" address on the internet (use ipconfig to find address) and  <port> is the port you configured in the Server Configuration.

If web server appears to be running but external browsers get no response verify that requests can come through the Windows firewall by using the following command:

netsh advfirewall firewall add rule name="TCP Port <port>" dir=in action=allow protocol=TCP localport=<port>

This command should then show a listener on <port>

netstat -a

Verify that port forwarding has been enabled on your router.