MotionTracking Graphical User Interface Reference

MotionTracking by
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Contents

1 Graphical User Interface

This subsection should provide a basic idea what the main interface items do. The procedures to actually use these to analyse your data will be covered in their respective subsections. For better understanding there is a screenshot of MotionTracking as you will face it when it starts and after you have loaded a project.
The individual elements of the MotionTracking user interface are described below. The menu itself contains a huge amount of functions which are too many to cover here and will be explained in other chapters as they become useful.
A lot of the interface items refer to objects or tracks which have to be calculated during image processing. Until this is done these items won't have any effect. Still they are explained here to maintain some sort of order.

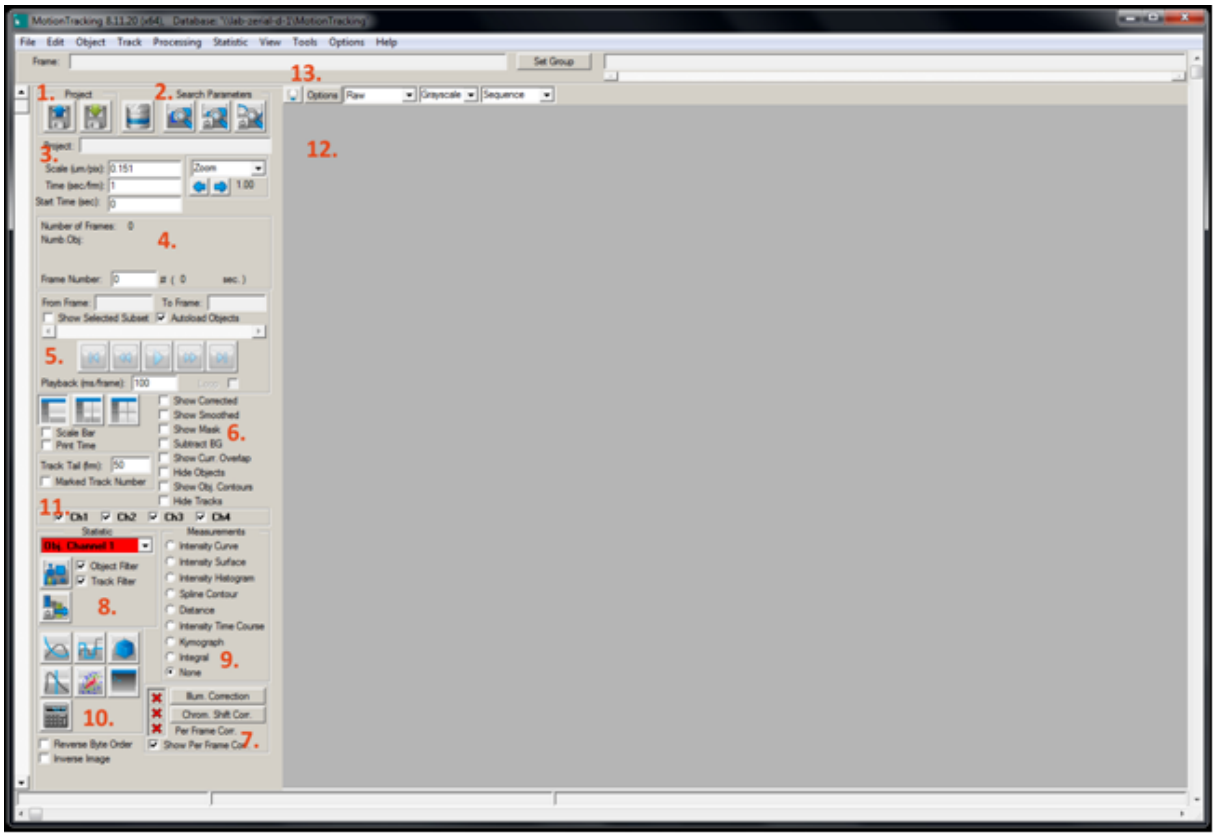

Figure 1: MotionTracking main window without any loaded data.

1.1 The Load and Save Buttons

The left, blue one is called "Load Project" and the right, green one is "Save Project". While the functions should be obvious it is important to know that both affect all related files like object search parameters. Thus, any change (except the statistics) will be controlled over these buttons. MotionTracking saves all related files under the same name with different extensions.

Example: If you load a project a.mtj MT will load a.srp, a.stp and so on from the same directory in the background. If you decide to save it as b.mtj it will create b.srp, b.stp and so on in the directory of b.mtj.

1.2 Search Parameters

These Buttons will open the "object usage list", "object search parameters" and "track search parameters" (from left to right). Their functions are covered in Chapter 4: Object Search and Chapter 6: Tracking.

1.3 Scale and Zoom

To produce meaningful results with MotionTracking you must set up the proper scale. The Scale (micrometers/pixel) allows you to set up the correlation between pixels of the image and the physical size of the objects that are displayed in the picture. Obviously this is extremely important if you want to measure size, area or elongation.

The Time (seconds/frame) is important if your data is a stream of images taken over time (called movie for MT purposes). The time/frame rate is necessary to understand the time steps between two images and measure speed or any rates of change.

These values are very important. Please take care to ensure they are accurate. The Scale is specified in micrometers (um) per pixel (pix). In most laboratories, the Scale is measured directly by

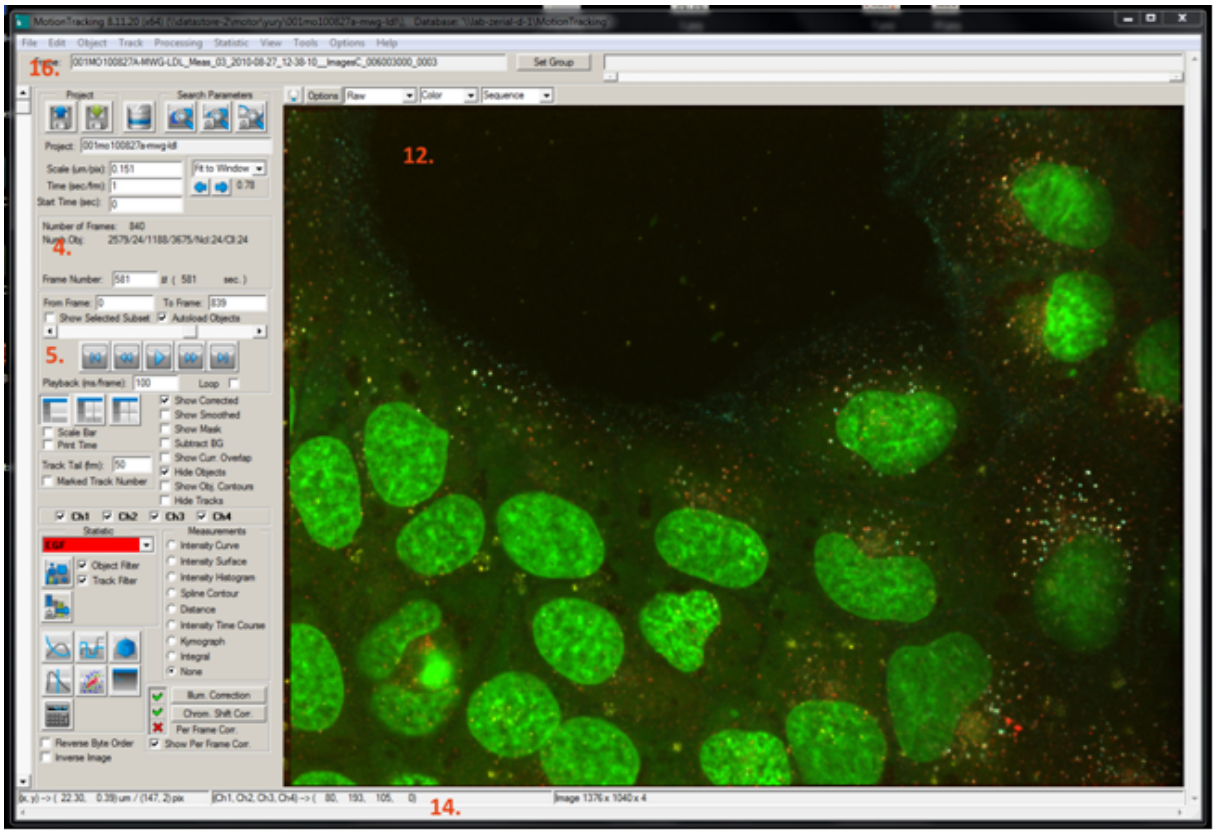

Figure 2: MotionTracking main window after a project was loaded.

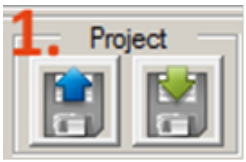

Figure 3: Load and Save Buttons

imaging a micrometer grid with your camera, objective lens, magnification settings, etc. This allows you to measure the size of your pixels in micrometers. The Time is specified in seconds per frame. The Rate was determined when the movie was first taken at the microscope. For example, if you set the microscope to capture one image every five seconds, the Time (sec/frm) is 5. If you set the microscope to capture one image every five minutes, the Time (sec/frm) is 300. The Time is not related to the exposure time of the camera, which could be identical in the two examples above (e.g., a 0.1 sec exposure time).

The Project field will display the name of the project as soon as one is loaded.

The “Zoom” Dropdown menu gives you the choice between ”Original Size”, which will scale the picture to 1.00 (100%) and “Fit to Window” which will scale the picture in a way that you will see the whole picture without having to move around with the scroll bars. As soon as you decide to zoom manually by dragging a box on the picture with your right mouse button it will change to “Zoom” automatically. At all times, the number below will show you the scaling factor. Once you zoomed manually you can use the arrow facing left to zoom back. The arrow facing right will undo the actions of the left arrow and therefore zoom in to your previously selected area. MT remembers several steps in every direction so you can jump between zoomed areas. Obviously you have to load a picture before trying this out.

Figure 4: Search Parameters

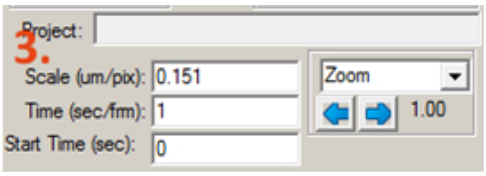

Figure 5: Scale and Zoom

1.4 Frame Information

Here you will find some general information about the currently displayed picture. The top row shows the total Number of Frames in the Project.

The second provides information on the number of Objects found. Until you have done that it will be empty. The Numbers will be shown in the order they appear in the "object usage list" (see Fig. 4 Search Parameters). If you decide not to calculate any object type which is specified in the "object usage list" it can lead to confusion because it will not show as a blank in this row. Example: you activated Channel 1, 2, 3 and 4but calculated objects only on channel 1, 3 and 4, leaving channel 2 untouched and get "Numb.Obj: 7/42/1234" it will mean that there are 7 found objects on the first, 42 on the third and 1234 on the 4th in this single active frame.

The last row shows the current Frame Number and helps you to navigate through the set of pictures. You can enter any number there and MT will jump to that picture. The time given in the brackets is a result of the current frame number and the time scale. (See Chapter **??** Export on page **??**).

1.5 Navigation

MotionTracking allows you to play your movies, scan through to specific frames, and control the playback rate. These features are stored in the "Navigation" panel. With the Movie Controls, you can play, pause, and fast-forward your movie. The buttons are similar to controls on a CD player, DVD player, or digital media player such as QuickTime. The slider above the buttons allows you to manually scan through your movie.

The Playback control (ms/frame) sets the playback rate for the movie. To show your data in real time, the playback rate should correspond to the frame rate used for image acquisition. However, the Playback rate can be set to any value, allowing you to accelerate or slow down the Playback of your movie.
Note: the fastest possible playback rate is limited by the capabilities of your computer.

The Loop option tells the program to loop your movie continuously. The movie will continue to loop until the option is unselected or the stop button is pressed.

An important feature is the Frame Subset selection. The frames selected by the From Frame and To Frame boxes are the frames that Motion Tracking uses for all computation. In other words, the Object Search, Track Search, and Statistics calculations will apply only to frames within the selected subset.

Frame Subset selection is very useful in the following circumstances:

- Selecting a single frame for testing of the Object Search procedure.
- Selecting a subset of frames for testing of the Track Search procedure.

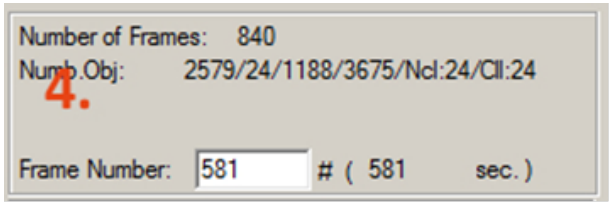

Figure 6: Frame Information

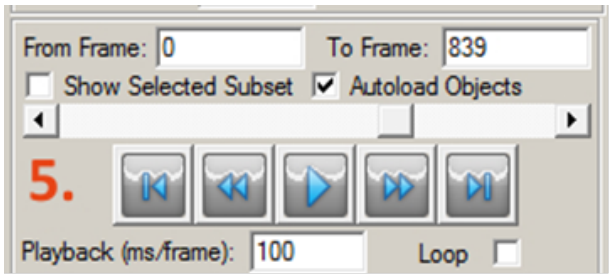

Figure 7: Navigation

- Looking at statistics for only a portion of the movie.

When a subset of the movie is selected, this is the only portion of the movie which plays. Therefore, the Frame Subset allows you to watch and loop only a portion of your movie.

Show selected Subset will restrict the frames that can be accessed in the movie control menu to the ones in the subset.

Auto Load Objects, on by default, is used to decide whether you want to load objects that were calculated previously when switching frames. Disable to speed up the movie, but remember that the objects will disappear (including the number of object shown in the interface).

1.6 View Setup

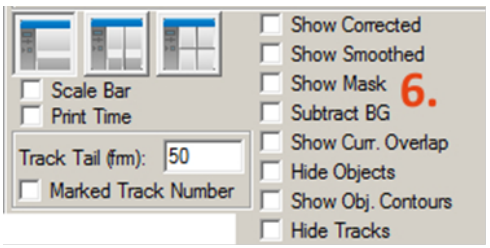

Figure 8: View Setup

These controls are used to specify what exactly MT should show you on the picture.

The 3 Buttons allow you to select if the picture view is separated in 2 or 4 fields which get their own 15 “View Options” and 19 “Brightness Control” bars which you can use to display the same picture in different colours and/or activate different channels to get a better view of the data.

You can activate the scale bar to get an idea of the size and print the time that has passed since the movie started. Both will be kept if the picture is exported. (See Chapter **??** “Export”).

When playing a movie with tracks the Track Trail allows you to specify how many frames the track path will be shown. A high number allows you to see more of the way the tracked object has travelled but may lead to confusion when there are a lot of objects close by.

The Checkboxes are one of the main tools to work with when viewing pictures. Note: All of these options will only affect the view, but never have any effect on the calculations.
"Show Corrected" is used to (not) view the illumination and chromatic shift correction, but not the per Frame Correction. See Chapter **??**: Image Processing.

The others are quite self-explanatory and toggle the views of different things which will be discussed later. Use these as you see fit to get a better view of the picture.

Additionally you should read the subsections 15 "View Options" and 19 "Brightness Control" for further manipulation of the display.

1.7 Illumination and Chromatic Shift Correction

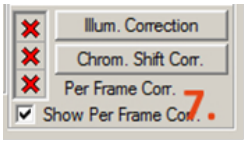

Figure 9: Illumination and Chromatic Shift Correction

The illumination and chromatic shift correction are covered in Chapter **??** "Image Processing" on page **??**.

By clicking on either button a dialog will pop up which asks you to load a file with the appropriate extension (.ilm and .chs respectively). If done, the red cross will turn into a green checkmark (as seen in Fig. 2 Overview with loaded project). If clicked again when the green checkmark is active the correction will be unselected and the red cross will appear again, giving you the option to load a different correction file.

The per frame correction is calculated in the object search menu and is, as the name suggests, individual for each frame. Therefore it cannot be loaded and is only shown for reference whether active or not. The checkbox has the same function as the "Show Corrected" in Fig. 8 "View Setup", but applies only for "Per Frame Correction" while the "Show Corrected" uses the illumination and chromatic shift correction.

1.8 Statistic and Filters

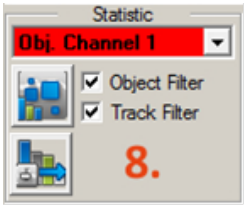

Figure 10: Statistic and Filters

This tool is used to control which objects or tracks will be included in statistic computations. This topic will be discussed in Chapter **??** Statistics on page **??**. The dropdown menu at the top allows you to decide which channel to use when calculating statistics individually and not in batch mode. The Checkboxes allow you to decide whether you want to use the object or track filters. These filters must be carefully set up in the object statistic parameters window which can be accessed with the upper one of the two buttons at the left of this box.

The lower button is used to specify the parameters of statistic distributions.

1.9 Measurements

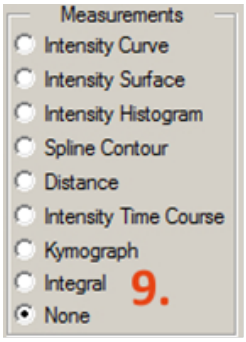

Figure 11: Measurements

This box is used to activate simple user-controlled measurements on the picture. They will be covered in Chapter **??** "Image Processing" on page **??**

1.10 Additional Tools

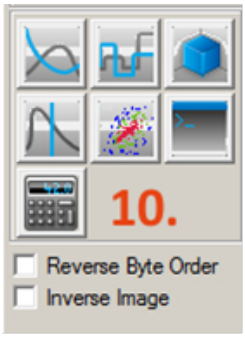

Figure 12: Additional Tools

These buttons open a lot of different tools. The top 3 open the Graph, Bar Graph and 3D graphs menus which you can use to visualize statistical data. They are followed by Time Course and Scatter Plot which are also valuable tools for data analysis. The last two items in the list are the text editor which is a sort if minimalistic notepad and the calculator.

The "inverse Image" inverts the colours channel by channel, so the bright spots become dark and vice versa. It may be necessary to adjust the result with "15. Brightness Control".

The "Reverse Byte Order" is not important (at least for now). Leave it as it is by default: unchecked.

1.11 Channel Activation

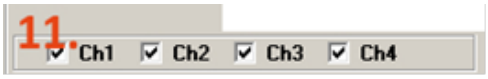

Figure 13: Channel Activation

Unselecting any colour channel will stop MT from calculating or showing the channel or anything that depends on it, though no information will be deleted.

1.12 Image Window

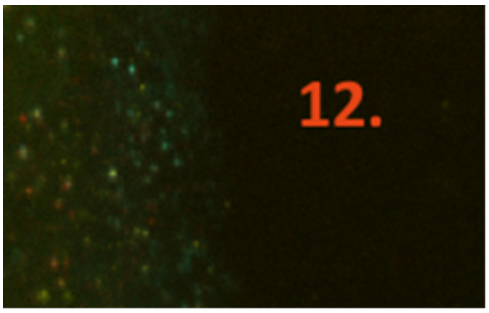

Figure 14: Image Window

This is the place where the picture will appear as soon as a project is loaded, if something besides "None" is selected in the first dropdown menu in Fig. 15 View Options.
If this doesn't happen there may be various reasons, but most frequently it happens because the database is not properly connected or something went wrong during import.

1.13 View Options

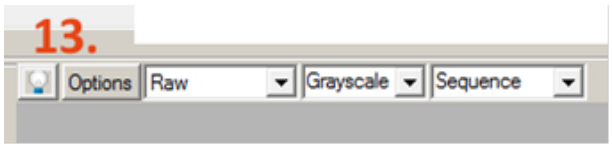

Figure 15: View Options

This is the main tool of view control. The light bulb on the left toggles whether "15. Brightness Control" is displayed. The three dropdown menus give you the following options:

- None, Raw, Synthetic and Background: "Raw" is the default option and displays the image as it came from the data source. "Background" will only show the background, which is calculated my MT. "Synthetic" is the signal, basically the difference between "Raw" and "Background". "None" will show no picture at all.
- Greyscale, Colour, Channel 1, Channel 2, ...: Are pretty much self explanatory.

The "Sequence" one is not relevant at the moment.
That leaves us the "Options" button. When pressed, the window shown in Fig. 16 "Options Button Dialog" will appear.

"Show Objects" and "Show Tracks" will open a dialogue where you can select or unselect by double-clicking which objects or tracks (channel wise) should be displayed. In the "Show Object Window" you additionally have the option to select "Object Contours" to be shown (if nothing happens, check if the "Show Obj. Contours" in Fig. 8 "View Setup" is disabled) . The contours are very helpful to understand whether the objects were calculated successfully. Unfortunately it is currently not possible to display

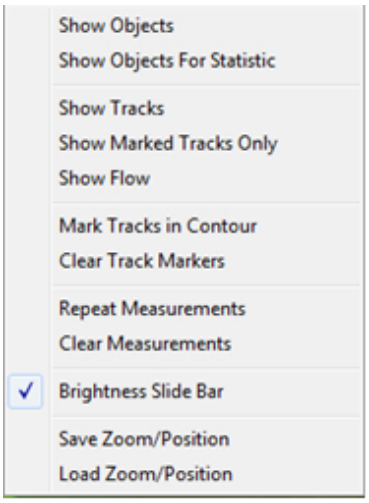

Figure 16: Options Button Dialog

contours without the object dot. Especially small objects may be obscured by the object dot. If this is the case, switching "Show Objects" on and off several times might help (remember the respective checkbox "Hide Objects" mentioned in Fig. 8 "View Setup".

1.14 Status Bar

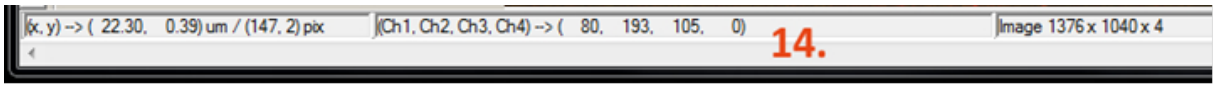

Figure 17: Status Bar

This bar shows general information. On the left you see the position of the cursor as x and y coordinates in micrometers and in pixels with the coordinate origin being the lower left corner of the picture. The middle block shows the intensity for each channel at the position of the cursor. The right box displays the resolution of the picture in pixels and the number of channels as the third number (in this case it is a 1376 pix wide and 1040 pix high picture with 4 channels).

1.15 Full Frame Name

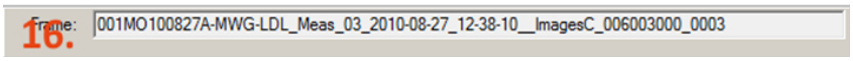

Figure 18: Full Frame Name

This box just shows the full name of the Frame for further reference if necessary.

1.16 Brightness Control

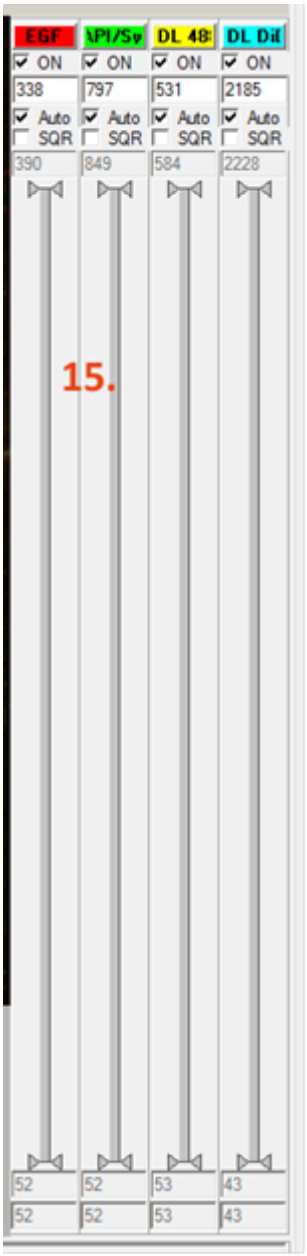

Figure 19: Brightness Control

This window is the last one which controls the view of the picture. It will be activated when clicking on the light bulb in "13. View Options".

The tool allows you to switch any channel on and off, but in contrary to Fig. 13 "Channel Activation" it will only affect the view, not the calculations.
By clicking on the coloured boxes with the channel name a dialog will appear asking you to choose the colour for this channel. Using this, you could make channel 1 which is labelled EGF in this case to be blue instead of red and so on. It is good to use bright colours to ensure good visibility.
The "Auto" checkboxes let the program decide how the image should be displayed in terms of brightness. Generally speaking, it should be a reasonable view. If you are interested in the dimmer objects, you can activate SQR which improves visibility in some cases.
If this is not sufficient, deactivate the Auto-Checkbox and drag the arrowheads on the line. The top arrowhead is at the intensity where the colour will be displayed in maximum brightness and the bottom one where it will be black. The numbers directly above and below show the numerical value of the arrowhead position.
The other 2 numbers set the range in which the arrowheads can be moved. The max value is between the On and Auto and the min value is at the very bottom of this window.